FACTORY

MANAGEMENT AND MAINTENANCE

A McGRAW-HILL PUBLICATION

JULY 1945

NEW PLANT PIONEERS A PRODUCT (SILICONES) AND HELPS CREATE A TREND (EXTERIOR USE OF COLOR)

The Annual Wage—Can It Be Guaranteed by Industry? . . . page 82

Here's how BYERS SNOW MELTING

kept this plant's driveway *clear* last winter

Pipe coils of Byers Wrought Iron were laid on a sand bed with reinforcing mesh above, and topped with 6-in. of concrete. Supplemental mesh was placed above each coil.

First test came on November 30, when a considerable snow and freezing weather struck. This was followed by 45 inches of snow between Dec. 12 and Jan. 2.

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In each storm, the installation speedily cleared the driveway. Users reported that within a few minutes after the snow stopped, the driveway was completely bare.

The heavy snows of last winter crippled many a plant by delaying material deliveries and hampering product shipment . . . and if yours was one of this unfortunate number, a new wrinkle used by the Hewitt Rubber Company at Buffalo, N. Y., may suggest a simple future defense.

A new driveway 12-feet wide and 80-feet long was put in last summer, with Byers Wrought Iron pipe coils beneath the concrete slab. The heating medium was exhaust steam at about 10-lbs. pressure. Coils were pitched so that the condensate would drain into a sump at the end of the drive. Plans called for continuous operation, starting about the first of November.

The winter provided a severe service test. During the 20-day period when 45 inches of snow fell, the thermometer never rose above freezing . . . and at times was down to zero, with a 45-mile wind blowing!

A similar installation, on a smaller scale, was made under a sidewalk at the Sarco Manufacturing Company plant at Bethlehem, Pa. Hot water was used as the heating medium, and completely satisfactory results were obtained.

Obviously, these installations call for unusual corrosion resistance in the pipe. Byers Wrought Iron provides it. In hundreds of applications where it has been buried for years in the ground or embedded in concrete, its superior durability has been convincingly demonstrated. In addition, the material is easily formed and welded; it has high heat emission; and it expands and contracts at practically identical rates with concrete, which helps protect against thermal cracks.

We have just produced a Case History showing a "round-up" of several installations. If you would like a copy, just write.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

Corrosion costs you more than Wrought Iron

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GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

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FACTORY

MANAGEMENT AND MAINTENANCE

July, 1945

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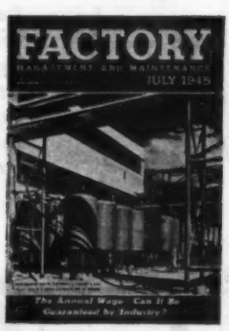

COVER PICTURE

Color accents Dow Corning Corporation's silicone plant at Midland, Mich., first in commercial production of these remarkable new materials. Kodachrome courtesy of *The Dow Diamond*.

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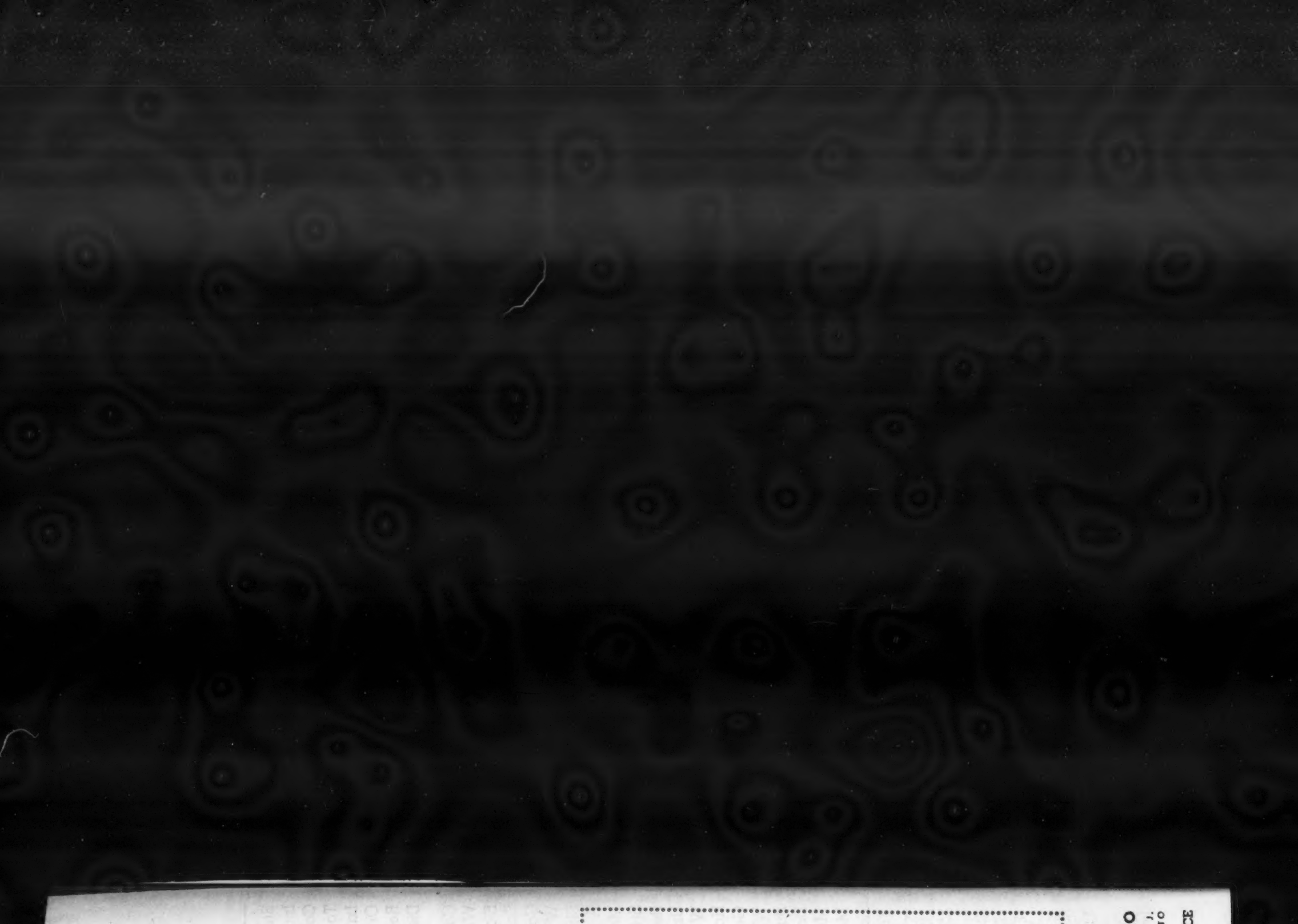

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STEADY JOBS *and* EQUIPMENT BUYING

SUSTAINED employment is not an attainable goal unless we can moderate the erratic fluctuations which have characterized the markets for producers' equipment in past periods.

In the 35th editorial of this series, "Sustained Construction Activity", it was pointed out that there is no specific that can cure our economy of its "boom-or-bust" proclivities. Rejecting the notion that the construction industry could be so managed as to stabilize business as a whole, that editorial stressed the important contribution it could make to that end, and suggested several practical expedients through which construction activity might be regularized.

Producers' equipment represents an area of production quite as broad and diverse as construction, though smaller in aggregate value. The classification embraces all types of durable equipment bought and used for profit—locomotives, motor trucks, electric generators, conveyors, machine tools, farm implements, and so on down to surgical instruments and dentists' drills.

Although the output of such equipment averages over a long period only 5 or 6 per cent of the nation's total output, it resembles construction in its extraordinary ups and downs. While its component items differ widely in the amplitude and violence of their fluctuations, the class as a whole is one of the most unstable sectors of the economy, making therefore a quite disproportionate contribution to the cyclical swings of total production and employment. From 1929 to 1932, for example, the decline in the output of producers' equipment (at constant prices) was 65-70 per cent, in contrast to a decline of 25-30 per cent in the national output exclusive of such equipment and construction.

A more recent example of the volatility of demand in this field may be found in the movement of a monthly index of orders for industrial equipment, which rose from 92 in the spring of 1936 to 160 in the spring of 1937, falling thence to 65 in the summer of 1938 and rising again to 142 in the fall of 1939. Such fantastic oscillations present an obvious and inescapable challenge to all concerned with economic stabilization.

Not only are these fluctuations bad for the economy; they represent demonstrably bad buying policy on the part of the purchasers of equipment. Peaks in demand come characteristically just before a business depression (1919, 1929, and 1937, for example) when machinery costs the most to buy and install and when it has the lowest expectancy of continuous use. At exactly the wrong moment everyone wants to buy. In the depression itself, on the other hand, with costs down, and with nowhere for the economy to go but up, equipment is a drug on the market. No one wants it when it is cheap and has the greatest prospect for steady employment. Here is a behavior pattern so profoundly irrational there must be hope for its correction.

There is an inveterate tendency for business management to forecast the future simply by projecting the trends of immediate past. Although it is axiomatic that the chance for an extended period of further prosperity is inversely related to the duration of the prosperity already experienced, this truism is generally ignored. The longer the boom has run, the more certain is business management that it will continue indefinitely. Convinced at last by "actual experience" that prosperity is here to stay, executives give the green light to commitments for expansion and modernization previously deferred in a skeptical attitude of "wait and see". The result, so often repeated in our economic history, is an explosive burst of demand for equipment coincident with, and contributing to, the final spasm of a boom. Witness the phenomenal rise in industrial equipment orders during 1928 and the spring of 1929.

The same prophetic illusion works in reverse during a depression. Recent experience is projected into the future. Although the mathematical probability of an imminent and prolonged period of prosperity increases directly with the duration of a depression, it finds little reflection in business decisions. Timidity and caution are the order of the day.

Compounding the errors caused by faulty perspective, are a number of influences which make it extremely difficult for individual enterprises to follow a policy geared to sensible long-term considerations. In a boom, particularly in its climactic phase, most producers find their order books crowded beyond the potential of their current capacities and are faced with the alternatives of expanding or losing trade to competitors. In depression the situation is reversed, and producers with unused facilities find it difficult to justify increases in their capital charges.

An even more controlling factor in many cases is the availability of funds. This is especially important

for small concerns. Typically such firms enjoy but limited credit, and with no ready access to the securities markets, their capital expenditures depend primarily on earnings. When they are making money, they can afford to buy equipment; when they are losing, they largely disappear from the equipment market. Even great enterprises, though less dependent on earnings as a source of capital financing, are profoundly influenced by the volume of internal funds available for the purpose, a volume as a rule far greater in prosperity than in depression. Moreover, it is usually easier in good times to obtain outside funds through the sale of stock or by borrowing, since in bad times bankers, underwriters, and investors are susceptible to the same timidity and caution that afflict business management generally.

We are dealing here with a combination of psychological, physical, and financial forces which conspire to aggravate the instability of demand for capital equipment. What can be done to reduce this instability and thus to bring equipment purchasing into a more sensible and constructive pattern?

There is no panacea, no royal road to the solution. The problem has been with us since the beginning of the industrial economy. It is complex and difficult. It is not, however, wholly intractable. We may reasonably hope that industry will, through intelligent effort, make substantial progress toward a satisfactory solution. The industrial equipment field is one in which government, except for war periods, has exerted little direct control. The best insurance against the institution of government measures is to so conduct activities in the equipment field that no justification for government interposition can be made.

☆ ☆ ☆

1. The first and most important step is for industry itself to reconsider its heretofore haphazard and opportunistic policy in the purchase of equipment, substituting so far as possible a regularized, long-range programming of expenditure that will resist both the excited long-buying of booms and the equally disturbing underbuying of depressions. Such long-range programming is particularly appropriate and advantageous for large enterprises in established industries such as railroads, electric power, steel, automobiles, and the like, but it makes sense much more generally.

Once executives come to realize that a reasonably stable equipment program contributes not only to the welfare of the economy but also to the lowering of their long-run equipment costs, the opportunity to combine a public service with private advantage should induce them to recast their policies accordingly.

There is an even more compelling reason for purchasers of industrial equipment to do everything possible to regularize their demands. Some concerns unquestionably will find themselves in a postwar position where speedy delivery of needed equipment, even though it involves the payment of premium prices, will seem to be justified. But there is no system of accounting that can show it to be a profitable transaction to promote an equipment industry boom that runs a brief course only to collapse when the backlog of deferred maintenance and development has been satisfied. That, historically, has been the trigger which trips the door to the depression phase of the business cycle. No immediate advantage can compensate for the contagious paralysis that infects all business enterprise when major layoffs occur in any major segment. No precautionary measures, self-imposed by business, can be regarded as unduly severe if they can prevent this devastating blight.

2. Financial agencies can and should play a responsible role in regularizing equipment demand. Funds for the purchase of producers' equipment should be offered boldly and at low interest during depression periods, and should progressively tighten as a boom market bids up the price of purchase and installation. Banks and financial houses have excellent facilities for gathering and interpreting market and general economic information. It is good business for them, and for the national economy, to exercise their accepted discretions in a manner that will help to promote economic stability.

3. There now is almost universal recognition of the need for a thorough-going revision of our corporate tax structure to the end that effective incentives may be offered for private capital investment. The possibility of including provisions which would offer special tax concessions to equipment investments made in depression periods is worthy of intensive exploration.

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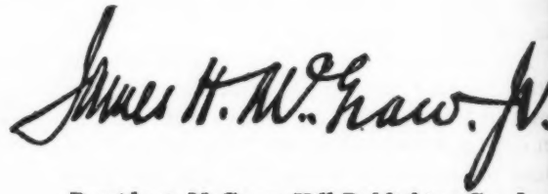
The fundamental problem here is educational. If all business enterprises in a position to do so were to regularize their equipment expenditures, it would have a tremendously beneficial effect. True, it would accomplish no miracles. For many concerns it is not feasible to schedule equipment buying over a long period. Even those who do schedule it are likely in practice to attain only a relative stability. It must be acknowledged, moreover, that few programs could withstand indefinitely a very deep and prolonged depression such as we had in the thirties. Nevertheless the adoption of stabilization policies where feasible would make a signal contribution both to the restraint of booms and to the mitigation of depressions. Here is something industry can do for itself.

It is easy to disparage such remedies for economic instability as are here proposed on the ground that they are partial only. However, joined with others also partial, they can achieve in combination a solid progress toward the goal of sustained high level employment—progress that is unattainable through economic cure-alls. The road suggested is a slow road, and difficult, but it leads upward.



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FACTORY
MANAGEMENT AND MAINTENANCE
L · C · MORROW · EDITOR

Industry's Cost for Freedom

Reconversion, even in the small scale now enjoyed, brings industry squarely up against the matter of paying for the freedom it wants after the war. Pay it must, unless willing to accept much of that government control which has been so irksome and so necessary during the war.

Industry will have to pay by scrambling for its materials while not enough are available to go around, in order to have materials control removed. And it will have to refrain from seeking or accepting exorbitant prices for its products, in order to have price control removed.

If WPB policy is followed, industry will be well served. In announcing, shortly after V-E Day, that priorities would be limited to direct military and war-supporting programs, Chairman Krug said:

"In this way, the choice of what and how to produce, buy and sell, after positive assistance to the military and essential war-supplying activities, will be left to the decisions of the thousands of manufacturers, wholesalers, retailers, farmers, and ultimate consumers rather than to government agencies and officials . . .

"The danger confronting us, as I see it, is that we will overlook the natural resilience of the economy—the capacity of manufacturers, wholesalers, and retailers to readapt themselves to changed conditions and hence quickly to utilize the resources released from munitions production. If we were to attempt in Washington to see that every manufacturer, wholesaler, or retailer got his exact share of released manpower or materials, we should be lost in a myriad of rules and regulations. We should get in the way of reconversion rather than speed it."

The "equal start" philosophy, which this policy opposes, would hold up everything until after the war if it were carried out literally. There will be inequities if controls are removed, but when has industry not faced the same or greater call for ingenuity, foresight, and resourcefulness?

Management is much disturbed by the thought of unemployment. It is fearful of government guaranty of jobs, made work, and deficit financing. Retention of the government controls referred to here would accelerate rather than retard those objectionable measures.

Tending to bring about employment by an industry free to exercise its own ability to get out of a jam are these factors: The existence of billions of savings waiting to be spent, and billions of unemployment funds in possession of the states. The availability of funds for veterans up to $1040 unemployment compensation plus as much as $300 demobilization pay. The need for replacement of production equipment worn out during the war. The accumulated need for consumer-durable goods which will be bought on deferred-payment plans.

Manufacturing efficiency, low-cost production, pricing for wide distribution—these are the procedures by which industry will supply the goods needed to bring those factors into play. They can be followed best under conditions of industrial freedom.

L C Morrow

Can Industry an ANNUAL

THE GUARANTEED ANNUAL WAGE will never get a chance to show its true worth if it is made the subject of arbitrary, irresponsible, and ruinous labor "demands." Yet it is now being used as a political football to stir up sentiment against management and to force action on schemes for government guaranteed "full employment."

Actually the annual wage idea is no more controversial than common honesty. The heat with which it is being debated today would be almost ludicrous were it not for certain ominous overtones in the origin of the discussion.

To begin with, there is nothing new about it. FACTORY has been presenting descriptions of various successful stabilized payment and employment plans for a good many years. These plans got all their early impetus from management, by the way, and were not always pleasing to labor leaders.

Immediate Application Demanded by CIO

Now CIO has suddenly pounced on the idea as though it were something that was just being heard of for the first time. Moreover, CIO leaders are "demanding" its immediate application in sectors of industry such as steel and automobiles where it has no precedent and where there is the least apparent chance of its succeeding.

This is unfortunate. In the hands of its new-found friends, the worthy principle of annual payment may easily be discredited. Its benefits would then be lost to the thousands of workers who might profit eventually from its more cautious application.

To set the record straight, therefore, and to correct the perspective in which the question is currently being viewed, FACTORY, speaking as a long-time advocate of rational annual payment plans, points out that:

1. The warmest sponsors of the guaranteed annual wage have never regarded it as an economic panacea. To assert that because it works well in a soap plant or a food factory, it should therefore be applied to the entire steel

WHY THE ANNUAL WAGE MAY BE PRACTICAL IN NON-DURABL

The year-by-year trend of activity in non-durable goods is fairly steady. Seasonal variations can be leveled off. That is why successful guaranteed annual wage plans are most likely to be found in this type of industry

Guarantee WAGE?

industry is manifestly absurd. One might as well contend that, because penicillin proves helpful in pneumonia, it should be used to set a broken leg.

2. The guaranteed annual wage has no more place than religion among the "demands" of labor upon most managements. Even though some of the details of existing plans are incorporated in union agreements, annual payment is historically a management practice, based on management decisions. To demand it is like demanding a change in merchandising and production policy (which it usually entails), in accounting methods, in capitalization, and in other matters equally remote from the legitimate sphere of collective bargaining. And there are whole industries in which it would be more logical for the unions to deliver their demands for guaranteed annual wages at the door of the consumer.

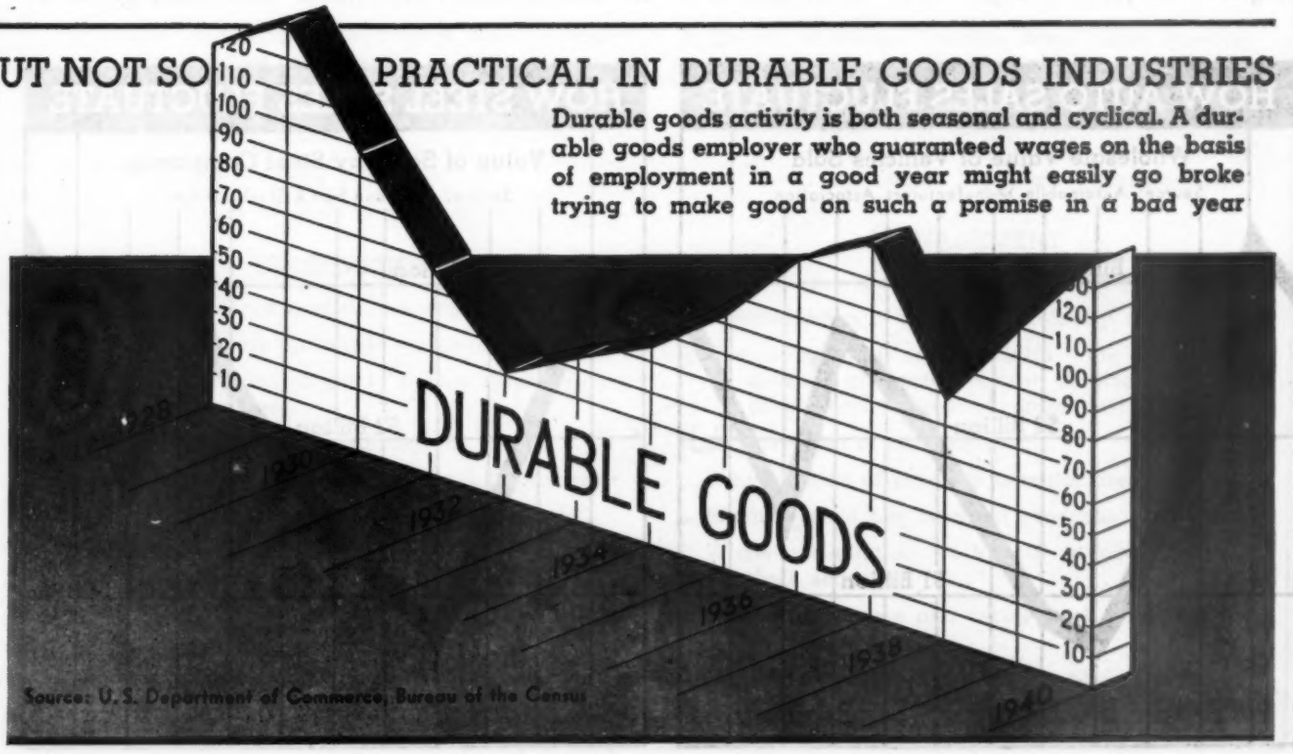
Political Expediency the CIO's Motive

It is time for industry to take a good look at the source of the current labor agitation for immediate, widespread application of the guaranteed annual wage. The evident motives of the CIO leaders who are making these demands deserve applause only for their calculated political shrewdness. (AFL's position appears to be about three paces to the right and rear of CIO on this question. AFL cannot afford to ignore an issue that proves popular with workers. On the other hand, the high hourly wage rates in the AFL crafts, the building trades especially, are largely based on seasonality.)

To begin with, no sane management man was ever opposed to the principle of annual payment. Management, to repeat, has *initiated* almost every successful annual payment plan of any age or standing to date. By diligent effort and careful experiment, management has made real progress with the idea. And, in each successful instance, management has been pleased with the results—for good, sound reasons of enlightened self-interest. Regular-

BUT NOT SO PRACTICAL IN DURABLE GOODS INDUSTRIES

Durable goods activity is both seasonal and cyclical. A durable goods employer who guaranteed wages on the basis of employment in a good year might easily go broke trying to make good on such a promise in a bad year



ized production, low turnover rates, low training costs, and improved morale are plain good business at any time, and they remain high among management's acknowledged goals.

It is impossible, therefore, for anyone to be "for" or "against" annual payment any more than it is possible to be "for" or "against" virtue. Why, then, this agitation, this controversy?

The reason is not far to seek. The idea of guaranteed payment is appealing to any worker. Belatedly capitalizing on this fact, CIO is loudly proclaiming itself "for" annual payment and maneuvering management into an unfavorable public relations position. For any management that protests against an unsound or unworkable annual wage proposal is then depicted as being "against" the whole principle.

Unwise Haste Would Speed Socialism

In the face of this fact, certain steel and automotive manufacturers have done industry a service by defending themselves, so far with success, against CIO's annual wage demands. In the course of this they have demonstrated again and again that the indiscriminate application of the annual wage might literally mean ruin to many companies and unemployment for their workers.

CIO leaders have brushed aside or ignored the possibility that unwise use of guaranteed payment might easily wipe out the jobs of thousands of the workers whose interests they profess to represent. The alternative to a shutdown would be for the government to move in and take over the affected companies and so preserve the jobs. It is just plain realism to assert that there are many men at the left hand of CIO's Philip Murray to whom this very thing is an end more desirable than the welfare of labor in collective bargaining under democratic capitalism.

As a matter of fact, the annual wage demand is linked directly to labor's drive for "full employment" in a totally planned economy. Some of its advocates have been frank enough to say so. For example, the International Union of Marine and Shipbuilding Workers-CIO, in announcing its campaign for a guaranteed annual wage, said candidly:

"We recognize . . . that guaranteed annual wage plans cannot be established on a nation-wide basis without establishing planned economy in America."

Of equal interest is this comment from an article in the Socialist publication, *The Call*, in which William Becker observes:

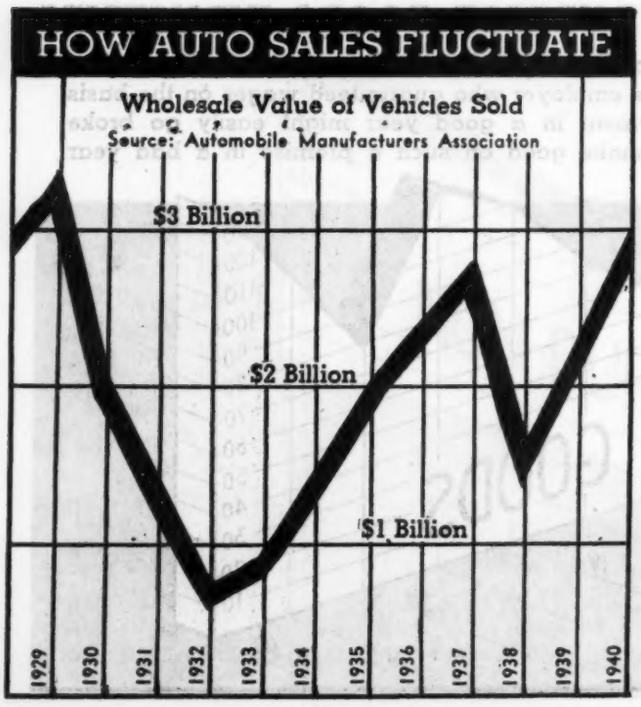
"If the steel industry or the auto industry should agree to guarantee the annual pay of their working force, they could do so only at a level of production much lower than their present wartime levels. But then there would be no demand for the labor of those not included in this original working force of these planned industries. The workers not included in the plan would be more permanently excluded from employment than before.

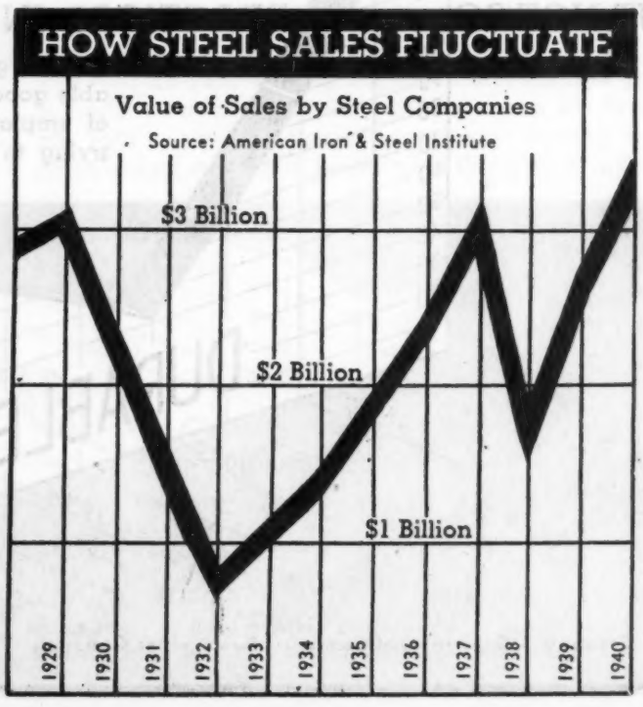
"It is this problem which makes so significant the fact that Walter Reuther (vice-president of the United Auto Workers-CIO) has come to speak of 'full employment and the guaranteed annual wage' as one demand. They cannot be separated without creating a permanent outcast class."

Wage Plans Still in Experimental Stage

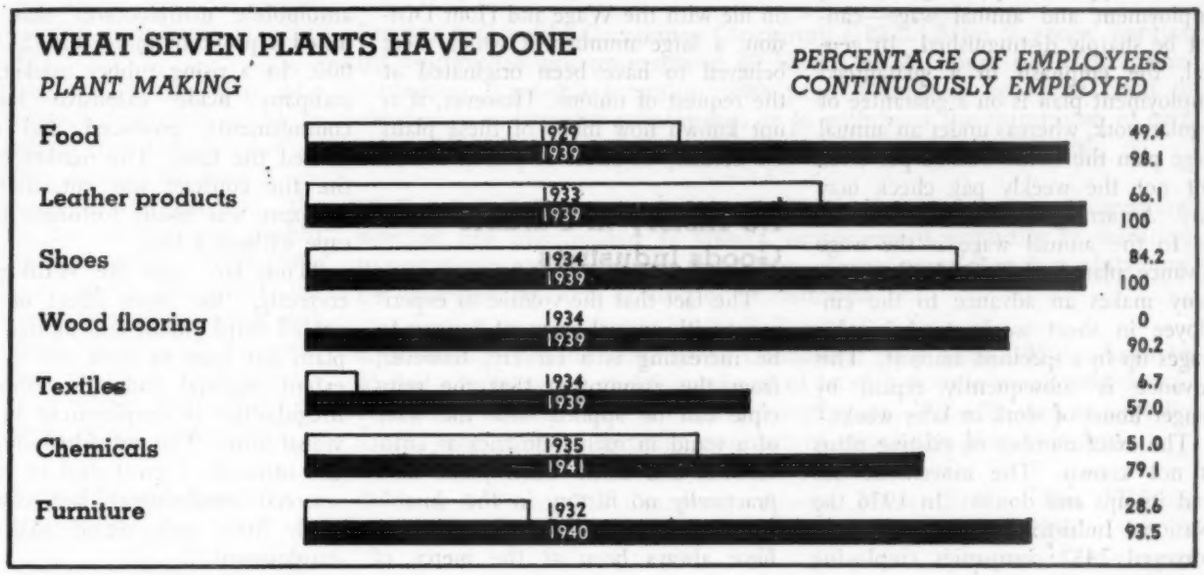
For many years employers have sought, by one means and another, to banish the fear of layoffs from the minds of employees. Trials have been many and errors frequent. At best it can be said today only that annual payment is still in the experimental stage.

Definitions, incidentally, are difficult to establish. Planned payment is one thing, guaranteed employment another. By and large, the great majority of plans presented in studies of "guaranteed annual wages" are much more limited than the phrase implies. Attempts to regularize employment are numerous, as are those in which employers and employees join in mutual savings plans to cushion unemployment. But broad guarantees





How to Work Toward Stabilization



Source: "To Make Jobs More Steady and to Make More Steady Jobs," Minnesota American Legion Foundation, St. Paul

Most plants can do much to regularize employment. Based on a study of 183 companies, the National Association of Manufacturers sets forth a list of things that will help to cut down layoffs. The following items are taken from that list:

PRODUCTION PLANNING

1. Forecast of sales volume based on a company's past records—careful study of the long-term trends in the individual company joined with the consideration of current business conditions.
2. Close coordination of manufacturing, sales, advertising, and warehousing departments.
3. Periodic review and check-up of sales estimates and business conditions.
4. Scientific production and inventory control.
5. Scientific budget control.
6. Study of warehousing problems.
7. Manufacturing for stock in slack seasons.

DISTRIBUTION

1. Stimulation of off-season business.
2. Special discounts for slack season orders.
3. Special sales campaigns to induce spreading the year's business.
4. Future billing for early deliveries.
5. Introduction of new models during dull seasons.
6. Use of advertising to change buying habits.
7. Advertising campaigns to develop new uses for old products.

PERSONNEL

1. Forecast of personnel requirements in relation to estimated sales volume and production budget.
2. Training of employees for greater versatility.
3. Departmental interchange of workers to dovetail busy and slack periods.
4. Use of "special squadrons" to carry peak production loads in different departments on a rotating basis.
5. Work sharing.
6. Flexible work week.
7. Placing key people on a salary basis.
8. Specialized groups of workers retained in off seasons at lower wage rates to do miscellaneous plant work.
9. Control of hiring—"holding down" labor turnover by avoiding production peaks.
10. Averaging of work hours—a method now subject to restrictions of the federal Wage-Hour Act but practiced effectively within the limits allowed by certain legitimate circumventions.

MANAGEMENT

1. Use of scientific management techniques.
2. Diversification of products seasonally.
3. Development of new products — the attempt to develop a greater volume of stock items to offset seasonal made-to-order business.
4. Improvement of old products.
5. Simplification of products manufactured.
6. Elimination of old seasonal products.
7. Waste reclamation work held in abeyance for slack seasons.
8. Plant maintenance and repair work also held for dull seasons.
9. Closed-down vacation periods to obviate hiring of extra workers for short period substitutions.

of work and pay are few. A recent War Labor Board study says:

"Two types of plan—guaranteed employment and annual wage—cannot be sharply distinguished. In general, the emphasis in a guaranteed employment plan is on a guarantee of regular work, whereas under an annual wage plan the hours worked per week but not the weekly pay check may vary. An arrangement somewhat similar to the annual wage is the wage advance plan under which the company makes an advance to the employee in short weeks to bring his wages up to a specified amount. This advance is subsequently repaid by longer hours of work in later weeks."

The exact number of existing plans is not known. The movement has had its ups and downs. In 1936 the National Industrial Conference Board surveyed 2452 companies employing 4,500,000 workers and found 39 companies with 143,000 workers operating under some sort of employment guarantee. In 1940 a Bryce Stewart report listed five guaranteed employment plans, nine annual wage plans, and five wage advance plans (not including agreements embodied in general union agreements). In the same year the Bureau of Labor Statistics examined 7000 union agreements and found fourteen stipulating some sort of wage guarantee but covering a total of only 5000 employees. At the same time the Conference Board found that of all employment-assurance plans in existence prior to 1929, only two were still in active operation.

Plans Encouraged by Federal Laws

By and large a considerable growth of interest in annual payment has been noted in the last six or seven years, and today there are probably more plans and experiments in progress than ever before.

The Social Security Act of 1935 enables states to grant lower rates to employers who guarantee 30 hours of wages for 40 weeks within 12 months. The Fair Labor Standards Act of 1938 gives employers who guarantee 2080 hours of work per year the right to run shifts of 12 hours a day and to work a maximum of 56 hours a week without premium overtime payment during rush weeks, provided the union joins in the request for permission.

The latter-day interest of the unions in guaranteed payment is probably reflected in the fact that, as of March, 1944, there were 57 annual wage plans on file with the Wage and Hour Division, a large number of which were believed to have been originated at the request of unions. However, it is not known how many of these plans are actually in effect at present.

No History in Durable Goods Industries

The fact that the volume of experiment with annual payment appears to be increasing is a far cry, however, from the assumption that the principle can be applied with the wave of a wand in such industries as automobiles and steel. *Such plans have practically no history in the durable goods industries where manufacturers have always been at the mercy of market developments beyond their control.* Says the WLB report:

"Practically all employment and wage guarantee plans are in either non-durable consumer goods industries or service and distribution. Where seasonal variations in employment are important, companies generally use an annual wage or wage advance plan. If employment rather than pay is guaranteed, the plan is usually restricted to a basic crew or a short period."

The 57 applications on file with the Wage and Hour Division in March, 1944, came from companies in the following industries: Textile printing and dyeing, 9; food products, 9; ice, 7; fur, 6; men's clothing, 5; metals and machinery, 4; utilities, 4; printing and publishing, 4; millinery, 2; wholesale, 2; feed, 1; transportation, 1; paper products, 1; billboard advertising, 1; fertilizers, 1.

Applications Emphasize the Real Obstacle

It is to be noted that many of these companies will encounter obvious seasonal problems in production, most of which can be overcome by revised scheduling. This merely emphasizes the true character of the obstacle that confronts the durable goods manufacturer. For upon the public purchase of automobiles depends the total employment not only of the motor manufacturers but also of all their subcontractors and suppliers of raw materials, including steel.

In the 1937 automobile boom, to cite one case, a tire maker had an original equipment contract with an automobile manufacturer that promised a profit of more than $5,000,000. In a rising rubber market, the company made extensive forward commitments, produced and warehoused the tires. The market broke, the tire contract was cut, and the company was finally fortunate to escape without a loss.

"Thus far," says the WLB report correctly, "the main effect of guaranteed employment and annual wage plans has been to even out to some extent seasonal and other short-run irregularities in employment in individual firms. The individual employer can often do a great deal to combat seasonal employment but comparatively little with regard to cyclical employment."

Regularization of Jobs the Real Goal

In the last analysis, the *regularization* and stabilization of employment is the best and broadest objective, both for management and labor, whether or not it happens to be formalized under some such slogan as the "*guaranteed* annual wage." And it is in this field that employers have worked most valiantly, regardless of labor "demands."

Much credit for the continued management interest in regularization belongs to the American Legion, which in 1938 approved the principle of experience rating in employment compensation. A leading spirit in this move, incidentally, was Jay C. Hormel, president of George A. Hormel & Company, Austin, Minn., meat packers. Under the auspices of the Minnesota American Legion Foundation, an Employment Stabilization Service was set up.

Making its appeal to sound self-interest, the Stabilization Service set out to show all employers how some employers were gaining not only in improved employee efficiency and morale but also in lower unemployment compensation costs through stabilization methods. To this end, it published a handbook, "To Make Jobs More Steady and to Make More Steady Jobs," containing 109 case histories of successful attempts to regularize employment. Few of these examples embody annual wage plans

as such, and fewer still are taken from the durable goods industries. But they outline fundamental job stabilization techniques, which underlie nearly every successful experiment (see list on page 85).

Reporting on 79 employers who tackled seasonal production problems in this fashion, the Service stated:

"Whether limited by natural circumstances or trade practices, the average for the 79 employers showed that the average number of man-hours required per week throughout the year was only 69 percent of the peak week. When they tried to do something about it, these 79 employers brought their average employment up to 84 percent of the peak week."

Hormel and Nunn-Bush Plans Worth Study

None of the cases reported is utopian nor is any on record. But two of the most encouraging and most worth analysis—both from the standpoint of their long record of success and their complete coverage of all employees in a plan that actually does provide steady work and pay—are the programs in operation at the Nunn-Bush Shoe Company in Milwaukee, (FACTORY, August, 1935, page 331; March, 1936, page 102), and the Hormel Company (August, 1940, following page 266).

FACTORY will not belabor its readers with another detailed report on either plan. Both have been described fully in past issues of this magazine, and both have been reviewed again and again in recent treatments of the current "annual wage" controversy. Both show what can be done by management ingenuity and sincerity to provide genuine job security in nondurable goods plants.

Another point—and one that makes the whole annual wage ideal so well worth striving for—is exemplified by Hormel. That is the beneficial economic effect on the whole surrounding community of steady "straight time" payment.

But one of the biggest points about the Nunn-Bush and Hormel plans, in the light of the current controversy, is that neither plan is an annual wage guarantee, pure and simple, in the airy sense in which CIO is posing its present demands. Neither simply says: "We will now promise to pay you for one year's work, no matter whether you work or not." And both are linked directly to production—the Nunn-Bush plan by a form of profit sharing, the Hormel plan by a bonus arrangement.

Selected Annual Wage Plans

Procter & Gamble Company, Cincinnati (1923). After 2 years' service all employees are guaranteed 48 weeks of 40 hours each per year, including 1 week's vacation with pay. Company reserves right to discharge or transfer employees, or to withdraw the guarantee at any time. Plan does not apply in certain of the company's plants.

McCormick & Company, Baltimore (1933). Employees, after 6 months' service, are guaranteed 48 weeks' employment annually in addition to vacations and holidays. Protective clause stipulates that plan may be canceled by Acts of God or catastrophe.

Cromwell Silver Manufacturing Company, New York (1933). Assures 45 full weeks' work and 6 weeks of at least 3 days a week additional. Company retains right to transfer employees. Plan limited to specific employees covered in union contract of which the plan is a part.

George A. Hormel & Company, Austin, Minn. (1933). See "What One Induustry Is Doing for America," *Factory*, August, 1940.

William Wrigley Jr. Company, Chicago (1934). Employees, after 6 months' service, qualify for layoff pay when work cannot be provided. This is a percentage of regular, expected earnings and is paid for 4 to 30 weeks, depending on length of service. Payment is on annual basis, but not guaranteed. About 1400 of 1600 employees earning less than $6000 a year participate. Plan is called "income assurance" and participants also get 3 weeks' extra pay a year plus vacations.

Nunn-Bush Shoe Company, Milwaukee (1935). For full account see "A Pay Check Every Week," *Factory*, August, 1935, page 331; "26 Pay Checks Later," March, 1936, page 102.

Richmond Piece Dye Works, Richmond, Va. (1940). Minimum of $18 weekly for men and $15 for women is guaranteed through life of union agreement. Covers about 200 employees having 1 year or more of service. Cost to the company is limited by agreement to $8000 a year.

From National War Labor Board Research and Statistics Report No. 25, "Guaranteed Employment and Annual Wage Plans," by Alice Lenore Nielsen.

Business Poll Shows Support of Plans

A Presidential committee, headed by Eric A. Johnston of the United States Chamber of Commerce, is now studying the whole question of annual payment in preparation of a report that will be submitted to the White House by the end of this year. Recently this committee polled 90,000 American businessmen and found that the majority favor some sort of guaranteed annual income for their employees.

This should refute any contention that management is "against" regularization of employment. It emphasizes again that the current controversy is largely the result of a manufactured agitation over a manufactured issue.

The challenge of unemployment, the fear of the layoff, the whole specter of economic uncertainty is, in fact, something that management wants to meet and conquer as much as any labor leader does. In time these things can be conquered—by careful study and thought, and by cooperative action on the part of management and labor.

To Lower Product Cost via Mechanized Handling

LEWIS K. URQUHART, Managing Editor, *Factory*

LIMITED FLOOR SPACE, shortage of manpower, and weight of product were the three main problems faced by F. A. Smith Manufacturing Company, Rochester, N. Y., when setting up a department for the production of 57-mm. high-explosive shells. The Smith people "looked at all three" and licked them by installing a mechanical handling system made up of three overhead chain loops and half a dozen sections of gravity roller conveyor. All of which has worked out so well that methods men at the company are already hard at work figuring out how they can apply the lessons learned in the production of war materiél to the peacetime manufacture of such items in the company's regular line as fractional horsepower motors, household fans, automobile switches, and circuit breakers.

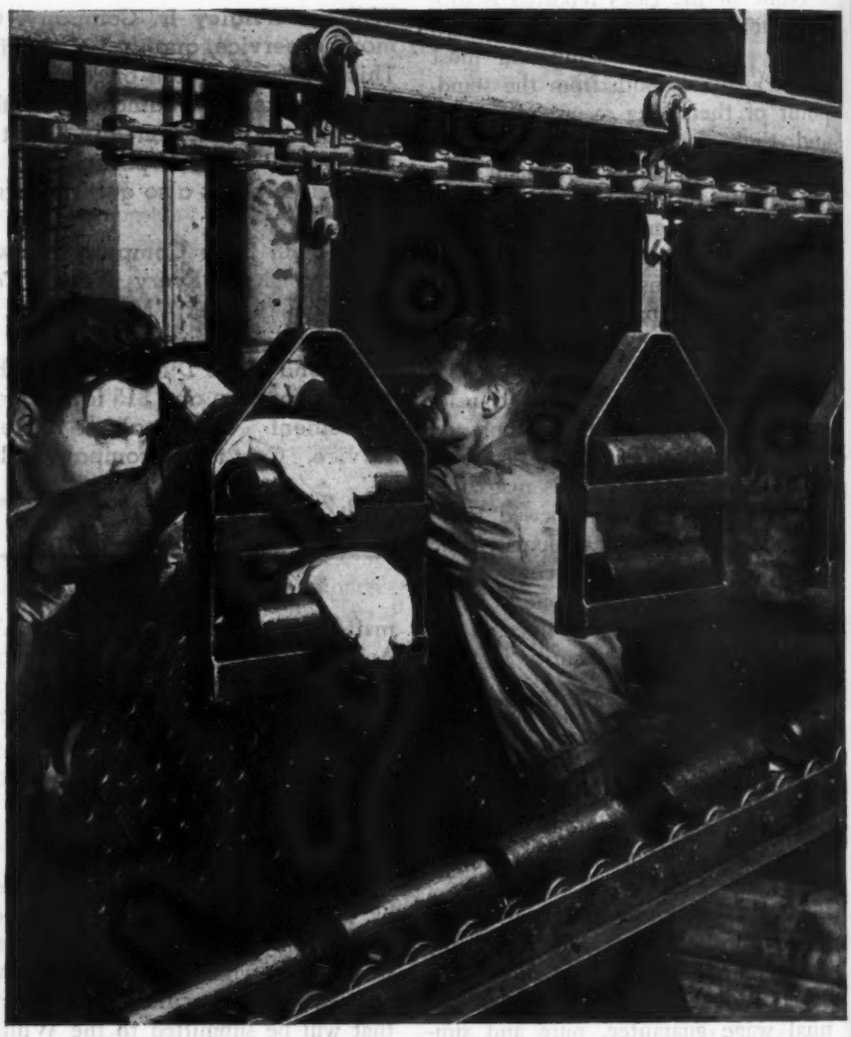
Advantages

No direct comparisons with other types of handling can be drawn because the present layout is, with minor modifications, the original one. However, there can be no doubt about the following benefits:

1. Manual handling is minimized. Shell forgings weigh close to 9 pounds at the start of the process, scale about 5½ pounds when finished. Handling is confined to a transport of a foot or two from conveyor to machine or workplace, and back to conveyor. This is especially important because 65 percent of the operators in the department are women. It means that workers handle shells at workplace level; there is no stooping and lifting; many of the workplace moves are slides. In short, operators expend their energy in productive work, waste none in nonproductive moves.

2. No handlers are needed. Nonproductive payroll is thus held down. Were it not for the mechanical handling system, a swarm of move men would be required to move shells from one operation to the next. A by-product is the elimination of most of the traffic in the aisles and the attending confusion. Aisles are kept clear for such unavoidable pedestrian traffic as that caused by set-up men and supervisors on their rounds.

3. Less floor space is required. In the first place, machines are closer together than would be possible if they were located on aisles; wide aisles are unnecessary. Second, there are no banks between operations to hog valuable floor space. The single exception to this rule is the bank (see layout sketch on following pair of pages) maintained at the centerless grinders—and the chief reason for maintaining this bank is because the shells come out of the grinders too hot to handle comfortably and too



Raw materials storage. Forgings are moved from trucks to bins via gravity roller conveyor in foreground. The two men are loading forgings on the first of the three overhead chain loops that move them through the department in a steady, continuous flow of work

Spot on second overhead conveyor line. Operators take shells from the conveyor, perform the operation (18 on the layout plan), and chute them to the inspectors in the foreground. Inspectors place the finished work back on the conveyor, which moves it on to the next operation in the line

hot to machine with best results at succeeding operations. The only other semblance of a bank is the occasional totepan of shells kept at workplaces by individual operators so that, on the rare occasions when they can't reach out and pick a shell off the conveyor, they will be able to go right on working.

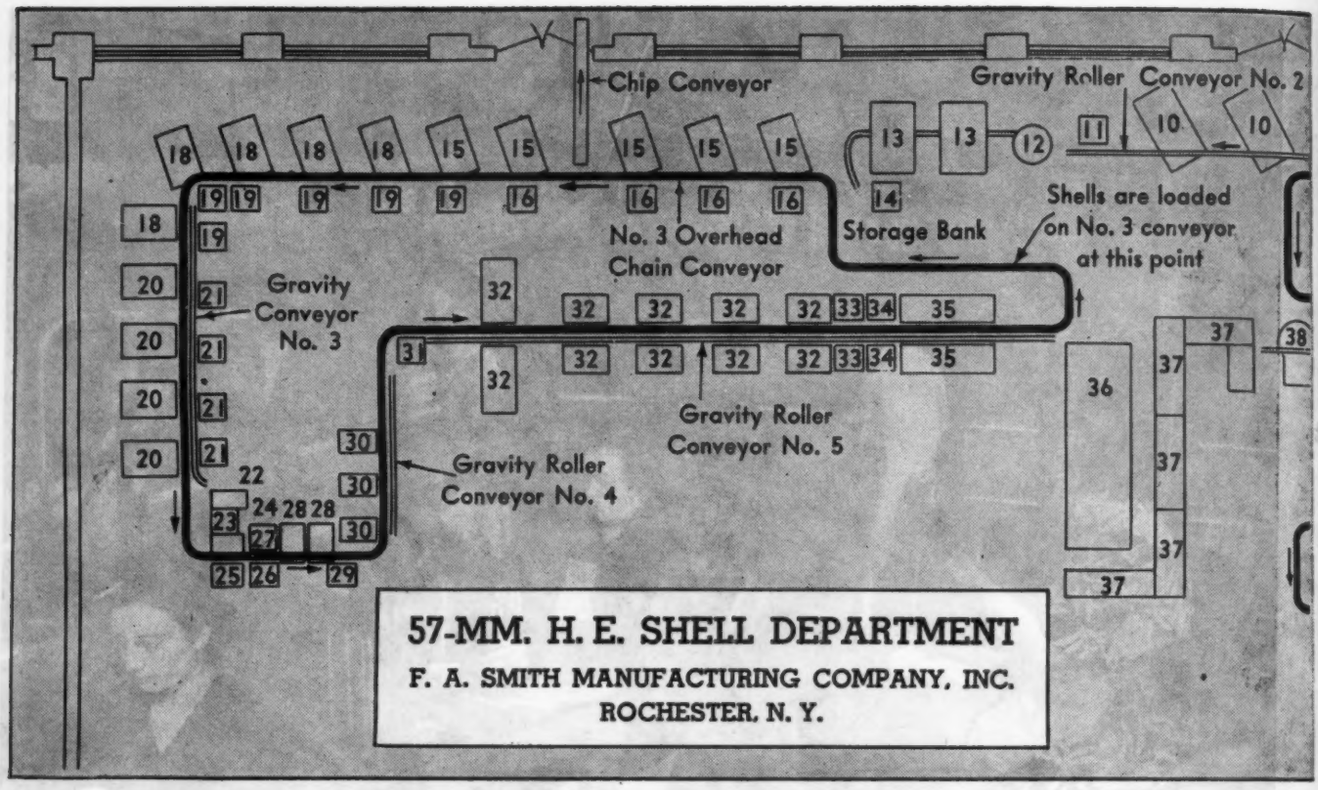
4. Work-in-process inventory is kept at the lowest possible figure. This permits quicker turnover of working capital. And the penalizing effect of a change in specifications—or even of a contract termination—is thereby minimized. Also, because work-in-process is kept low, there is less danger of spoilage. Given half a chance, shells rust in no time at all. There is not a tenth of a chance here; shells are constantly on the move—usually the finished shell goes out the door the same day the rough forging goes into the line.

5. Scheduling is simplified. Ease of scheduling is a natural sequel to low work-in-process inventory. With a constant stream of forgings from suppliers, and with regular withdrawals for the conveyor, it is a simple trick to plan production. Likewise, because the conveyor moves work at a constant speed, it is possible to time the flow of work accurately from operation to operation, and thus to balance the line.

6. Close control is possible. Paperwork is cut to the bone. There are no move tickets, of course. The departmental budget is relatively easy to set up and to stick to. Less supervision is needed. One man can supervise more people. Delays and mistakes are quickly detected and corrective measures initiated.

7. The conveyors set the pace. There is nothing on the shell manufacturing line that resembles the so-called speed-up. Flow of work is regular, unceasing, just fast enough so that operators have no difficulty keeping up. There is no chance for soldiering on the job, even if some worker felt so inclined. Operators are held to their posts simply because the conveyors and the work on them are moving—excepting during rest periods. No one slips out, therefore, for that extra, unnecessary smoke.

8. Bottlenecks can't develop. At the first sign of one, the supervisor can spot it and take steps to correct it. Short of a major cataclysm, there is virtually no possibility of stoppage. In almost no instance can a single machine, by going out, shut down the entire line. As to trouble with the conveyor, there is little or no chance of that with this type of installation. The possibility of complete stoppage is further minimized by the maintenance


Chip Conveyor
Gravity Roller Conveyor No. 2
No. 3 Overhead Chain Conveyor
Storage Bank
Shells are loaded on No. 3 conveyor at this point
Gravity Conveyor No. 3
Gravity Roller Conveyor No. 5
Gravity Roller Conveyor No. 4
57-MM. H. E. SHELL DEPARTMENT
F. A. SMITH MANUFACTURING COMPANY, INC.
ROCHESTER, N. Y.

Shell forgings move through the department on a handling system that is made up of three loops of overhead chain and half a dozen sections of gravity roller conveyor. Flow of work is steady and continuous. The numbers on the layout sketch (above) refer to the sequence of operations (on facing page)

of the storage bank (already referred to) at the point where the shells are loaded on the third overhead conveyor loop.

9. The handling job is safer. There are practically no handling hazards with this type of operation. Workers never pick up more than one shell at a time. No need here, in short, for the proverbial strong back and weak mind—and thus no hernias. Likewise the risk of accidents caused by falling shells from piles in temporary storage has been eliminated. In locations where the overhead conveyors ascend above the normal work level, wooden trough-like guards prevent the possibility of a shell falling and injuring a worker.

10. Production is balanced. Installation of the conveyor system focused attention on the need to study operational speed, and made it necessary to break jobs down into their smallest components. The conveyor system would not work unless the operations performed from it were carefully balanced. Detailed studies of machine methods and operators' techniques led to many production improvements.

So much for the advantages. They far outweigh the disadvantages, of which there are a few. For instance, single-purpose machines with higher output per man-hour than the line are necessary, but cannot be used to maximum capacity. Changes in specifications—there have been two since the line went into operation last December—may mean that the line will have to be revamped. This, however, has not proved a serious obstacle, and the necessary changes were made without too much trouble or delay. Furthermore, it has not always been possible to utilize set-up men to the maximum of their capabilities. And, of course, the conveyors themselves could go wrong. The fact is, they don't.

Integrated System

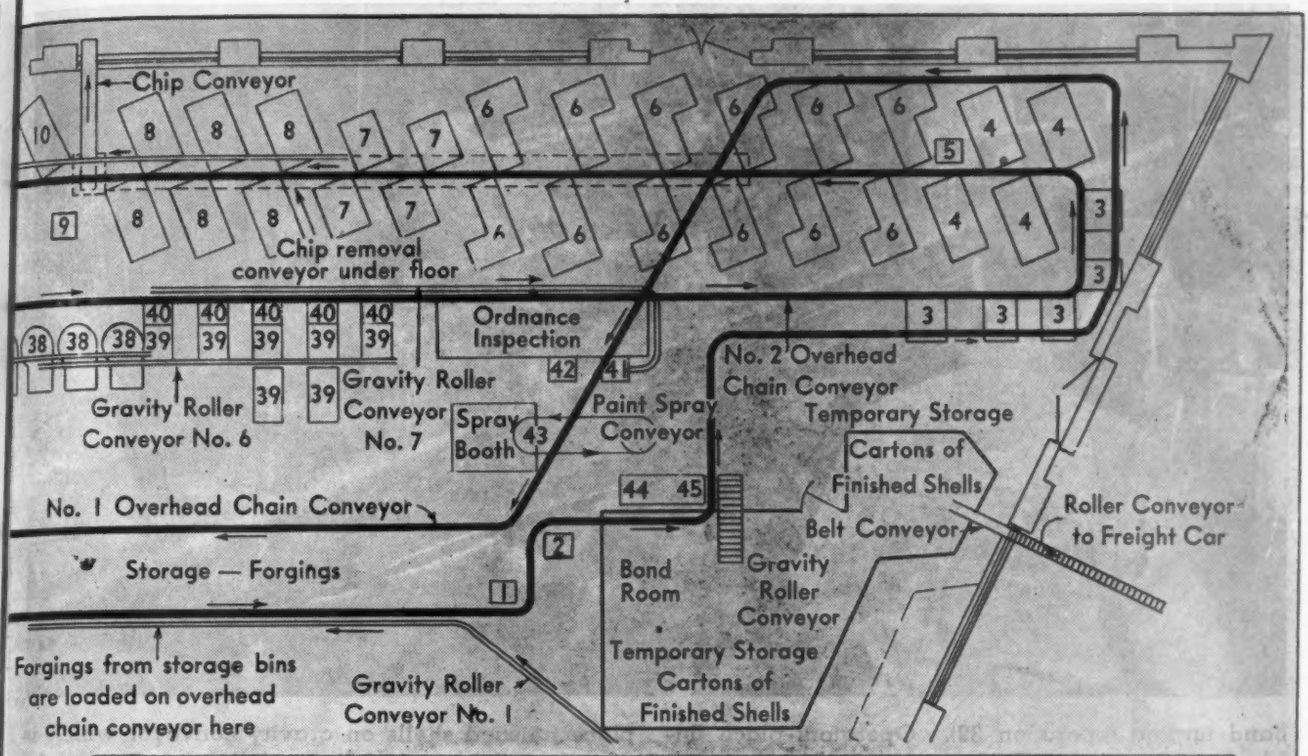
As already stated, there are three overhead chain conveyor loops tied together to make an integrated handling. system. Reference to the layout sketch and the sequence of operations will show that the system functions, and the following brief description will serve to supplement the information thereby gained.

Mechanized handling begins, as it should, with the receipt of raw materials. Shell forgings arrive at the plant via truck and are unloaded directly to a gravity roller conveyor which moves them to the raw materials storage area where they are stacked in bins. It is possible to unload three trucks of forgings simultaneously.

Forgings are loaded at the storage bins to the first overhead chain conveyor, which is equipped with specially designed carriers of welded construction, each holding two shells. This conveyor takes the work over to a rough facing operation (No. 3 on the sequence list and layout diagram). The operators at these five machines take the work from the first conveyor loop at their left, place finished work on the second loop at their right. The second loop then moves the work through rough and finish turning operations (Nos. 6 and 8). At these machines the operators take the work from the conveyor carriers, replace it on the carriers when finished. Because of the nature of the operations performed here, it is easy for the operators to spot the forgings on which their particular jobs have been done and those on which they have not yet been performed.

At the next operation, No. 8, the work is taken from the overhead conveyor but is returned to a double-decked gravity roller conveyor on which it is carried through succeeding operations up to and including the centerless grinders (No. 13).

It is at this point that the steady


Chip Conveyor
Chip removal conveyor under floor
Ordnance Inspection
Gravity Roller Conveyor No. 6
Gravity Roller Conveyor No. 7
Spray Booth
Paint Spray Conveyor
No. 2 Overhead Chain Conveyor
Temporary Storage Cartons of Finished Shells
Roller Conveyor to Freight Car
Belt Conveyor
No. 1 Overhead Chain Conveyor
Storage — Forgings
Bond Room
Gravity Roller Conveyor
Temporary Storage Cartons of Finished Shells
Forgings from storage bins are loaded on overhead chain conveyor here
Gravity Roller Conveyor No. 1

SEQUENCE OF OPERATIONS

1. Inspection
2. Grind cavity
3. Rough face rear end
4. Center drill
5. Inspection
6. Rough turn o.d.
7. Rough turn nose
8. Finish turn o.d.
9. Inspect o.d. of operation 8
10. Semi-finish rear of shell
11. Inspect thickness of base
12. Hardness test
13. Centerless grinder
14. Inspection of O.D.
15. Turn band seat and finish rear end
16. Inspection
17. (Discontinued)
18. Turn nose profile, face nose
19. Inspection
20. Drill tracer hole
21. Inspection
22. Ream tracer hole
23. Inspection
24. Notch
25. Countersink tracer hole
26. Burr tracer hole
27. Inspect operations 25 and 26
28. Knurl
29. Inspection
30. Bore
31. Inspection
32. Tap
33. Inspection of operation 32
34. Wash cavities
35. Inspection of operation 32
36. Wash
37. 100 percent inspection (15 inspections)
38. Band assembly
39. Band turn
40. Inspection
41. Check for weight
42. Mark
43. Paint
44. Inspection of operations 42 and 43
45. Pack

forward movement of the shells is stopped for the first and last time during their progress through the department. And, as already stated, the storage bank here is maintained for the dual purpose of allowing the shells to cool and to provide a margin of safety in case a temporary stoppage occurs at any previous point in the process.

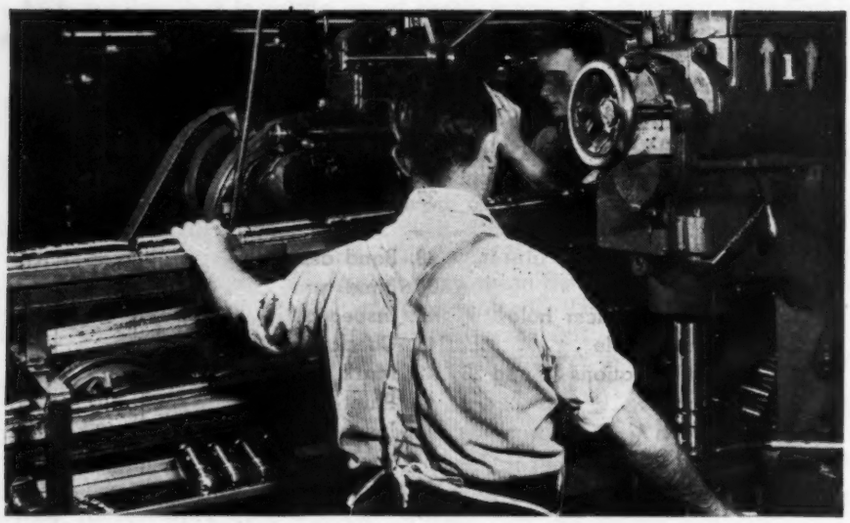
Also at this point the third conveyor loop takes over and moves shells through operations 15 and 18. At 15 the machine operator takes the shell from the conveyor, performs the operation, and hands the shell to the inspector (one at each machine). The latter gages the work, replaces the shell on the conveyor. At 18, the routine is similar, except that the shell is chuted from operator to inspector.

Here a third section of gravity roller conveyor is installed. At 20, the work is slid across the table to inspectors who replace it on the roller conveyor. Shells ride the latter through a series of quick operations, are replaced on the overhead conveyor at the boring mills (No. 30) where once more a gravity roller section takes over.

Inspection Point

At the end of this conveyor there is a gap of about 3 feet which is bridged by the inspector (No. 31) who inspects the boring operation visually and places the shells on a fifth section of roller conveyor, also

Band turning (operation 39). Operators place finished work on short section of gravity conveyor which moves it to inspectors in the background, who place finished shells on gravity conveyor which is directly adjacent to their workplaces. Beyond inspectors, empty carriers of second overhead loop



At operation 32 (see layout diagram on pages 90 and 91) gravity roller conveyor No. 5 takes over the handling job. Here shells pass between two rows of tapping machines. Operators take new work from the lower deck of the conveyor, place finished work on the upper

double-decked, which runs back down the room between two rows of tapping machines. Operators take work from the bottom deck, replace it on the top. It moves via the conveyor through an inspection, a washing operation to remove chips from cavities, and another inspection, and is then removed to the conveyor that takes it through the washer (operation No. 36 on the layout).

Following this washing, rinsing, and drying operation the shells are moved through a series of fifteen inspections (marked No. 37 on the diagram), being slid along a steel-topped bench from one inspector to the next. Again there is a gap at the end of the inspection table which is bridged simply by having a man transfer the shells from the table to the bottom deck of a sixth section of roller conveyor. Once more, at the band assembly operation which follows immediately, the operators take the work from the bottom deck, return it to the upper, but at the next operation, band turning (No. 39), the work is moved to inspection (40) via individual roller sections installed at right angles to the flow of work. The inspectors, in turn, place finished work on still another roller conveyor section which is immediately adjacent to their workplaces.

All that's left now is a trip through the ordnance inspection room, where a sampling inspection is performed, to be followed immediately by painting, packing, and removal to a waiting freight car.

Delivers the Goods

There, in a few broad strokes, is the handling picture in F. A. Smith's shell department. Any good methods man can take a look at the layout and brush in the details. And if the same good methods man chooses to do a little sharpshooting, he can no doubt punch a few holes in it. Not perfect? Of course not. No one is more conscious of a few fairly obvious shortcomings than the men who set it up.

The point is, this handling system is working. It's delivering the goods. And it's delivering them with ease and dispatch—at something pretty close to lowest possible unit cost. That, as America moves toward V-J Day, seems to be the answer.

Labor Union Membership

January, 1945

More than half a million workers were added to union coverage last year. By the beginning of 1945, a total of 14⅓ million workers in the United States were covered by union agreements.

The type of clauses under which union workers are bound to union membership are:

Closed Shop. All employees in the bargaining unit must be union members and employee placement is handled by the union.

Union Shop. Union membership obligatory. Employer does the hiring.

Maintenance of Membership. Employees within the bargaining unit who have joined a union must remain members during the term of the contract as a condition of employment.

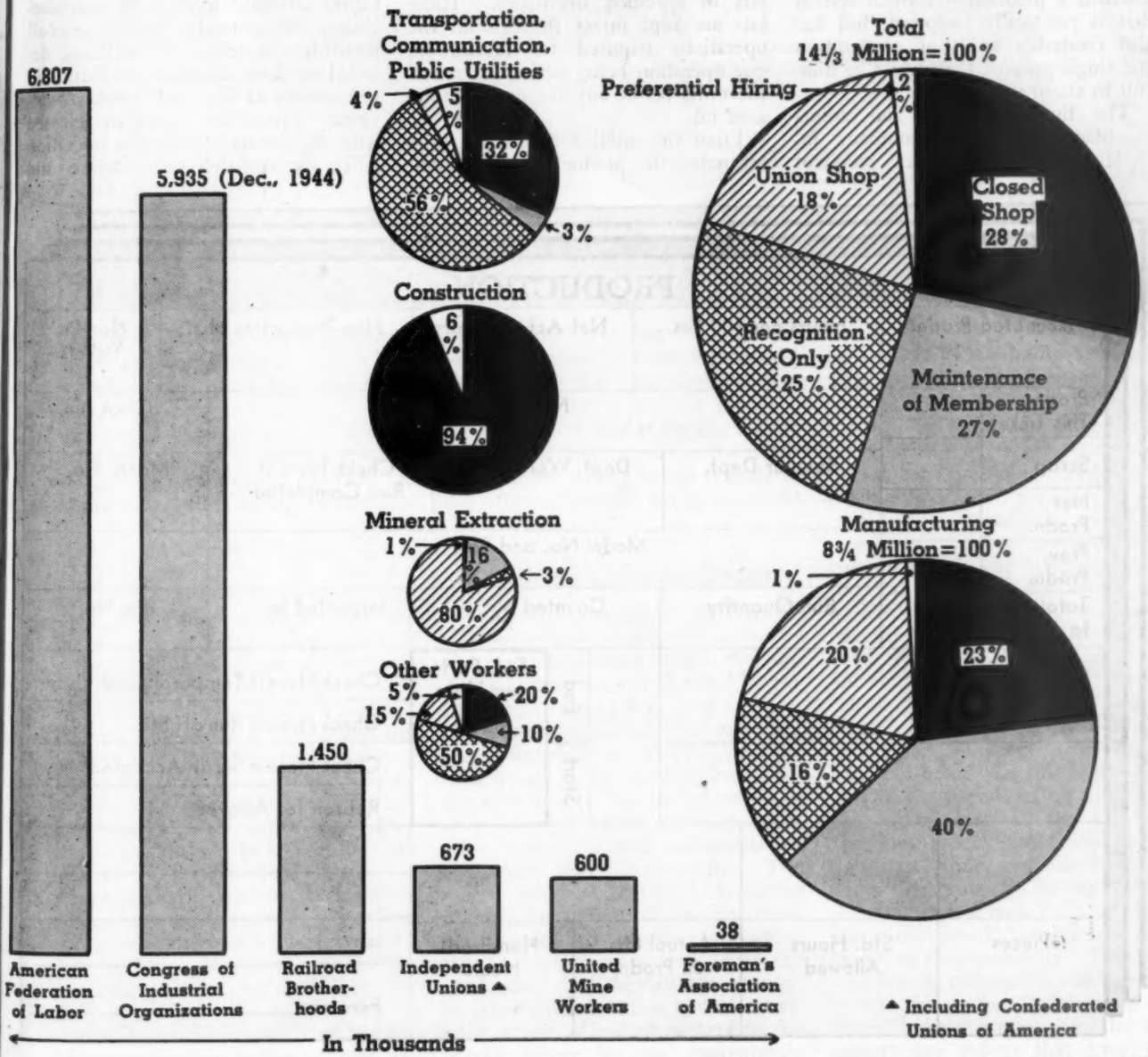
Preferential Hiring. Union members are given hiring preference.

Recognition Only. Union is the bargaining agent of the unit, but employees do not have to be members of the union.

Membership figures are those claimed by the respective unions. Some of the Railroad Brotherhoods belong to AFL unions.

Sources: U. S. Bureau of Labor Statistics; labor unions; National Industrial Conference Board.

TYPES OF COLLECTIVE BARGAINING AGREEMENTS



The above charts are based on National Industrial Conference Board figures, and are published in NICB's series, "Road Maps of Industry"

One-Form Dispatch Plan Keeps Work on the Move

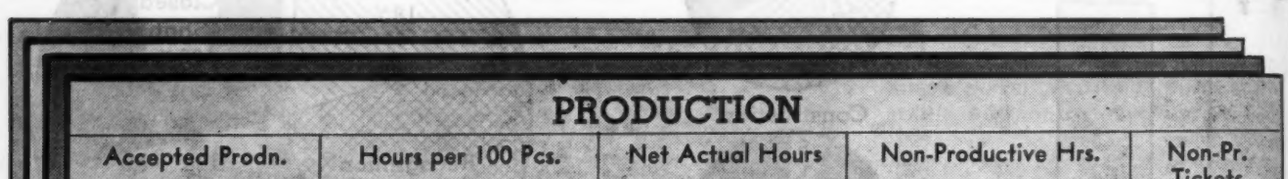
R. M. TOPPIN, Production Manager, The Jacobs Manufacturing Company, Hartford, Conn.

BY ELIMINATING purely clerical operations with the probability of error and misinterpretation, by using a method incorporating complete visibility, and by including operating men and foremen in the planning organization, The Jacobs Manufacturing Company, Hartford, Conn., has not only installed a production control system that is practically foolproof, but has also created a spirit of cooperation and single purpose that would be difficult to attain in any other way.

The line of chucks and arbors manufactured by this company includes 120 models and sizes. Some of the parts are interchangeable, but there is a total of 214 different pieces. The difference between them may only be a matter of one or two operations or there may be no comparison.

Parts are produced on factory orders and are routed through the plant from raw material to finished stock in lots of specified quantities. These lots are kept intact through all the operations required for fabrication, one operation being performed on all the units before any are moved to the next job.

From the unfilled orders and sales estimates, the production department sets up future production plans which are used to maintain a master schedule four months in advance of factory operation. From this schedule, machine-hour calculations are made for group centers, and capacity requirements are determined to inform the manufacturing departments as to their future monthly loads. All manufacturing departments receive over-all monthly schedules. In addition, detailed machine schedules are furnished key centers at least two weeks in advance. Production orders are released with the material to the first operation when the dispatch system starts and



PRODUCTION

Accepted Prodn.	Hours per 100 Pcs.	Net Actual Hours	Non-Productive Hrs.	Non-Pr. Tickets
Prodn. This Ticket	NAME			Clock No.
Scrap	Regular Dept.	Dept. Worked in	Check Here if Run Completed	Mach. No.
Net Prodn.	Model No. and Part			
Prev. Prodn.				
Total to Date	Run Quantity	Counted by	Inspected by	Run No.

	End	Std. Parts per Hour	Check Here if Temporary Std.	
			Check Here if Run off Std.	
	Start		Check Here if Scrap Accepted	
			Reason for Above:	

Pieces	Std. Hours Allowed	Actual Hrs. on Prodn.	Non-Prod. Hours	
				Foreman

Figure 1. On this form (actual size, 3½x5 inches) appears all the information needed for shop and office control. Data are reported and recorded at different times, but any one fact is entered only once

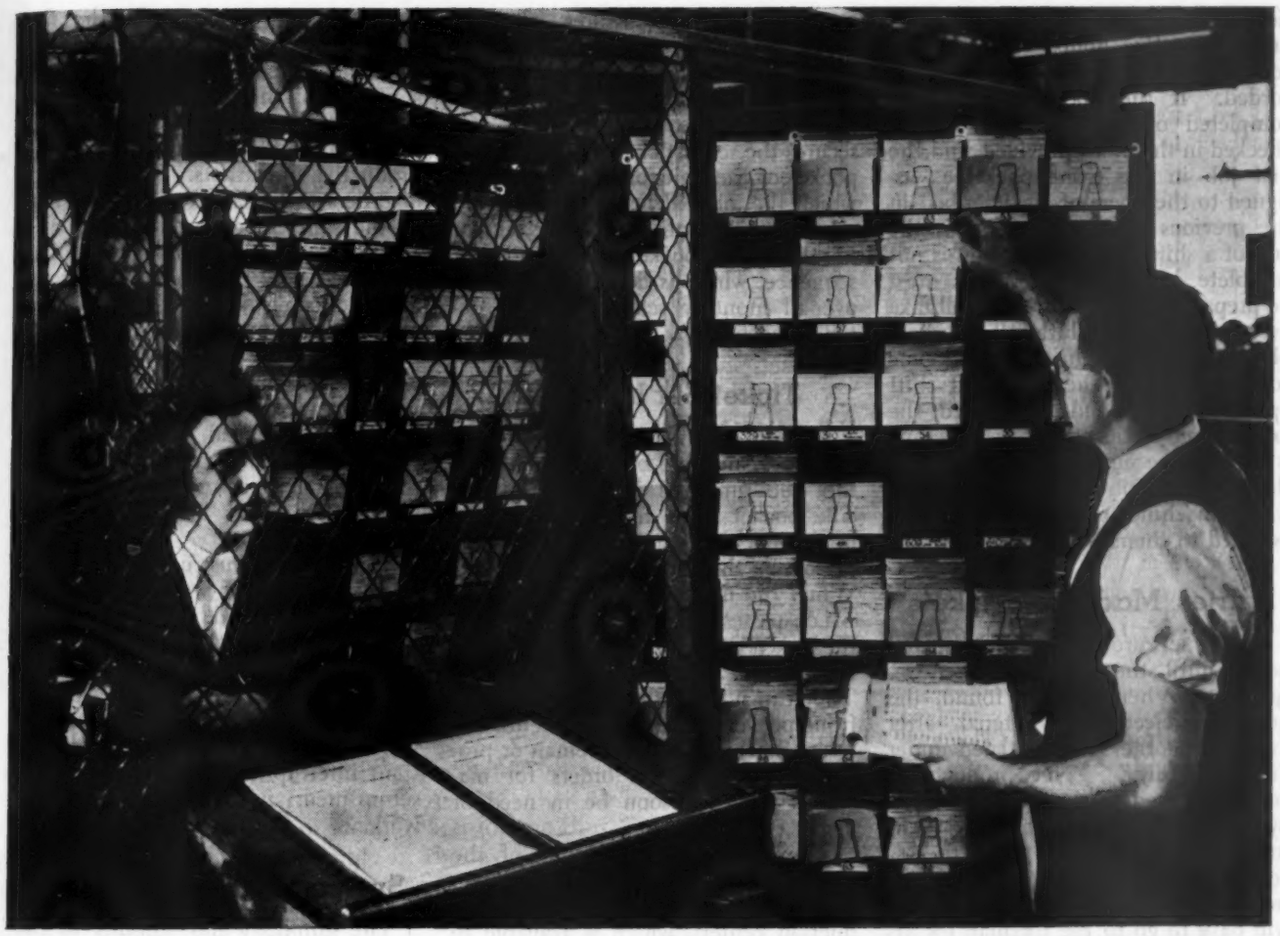


Figure 2. Sides of the dispatch booth are banks of machine load pockets, which hold the "production" tickets. Each bank has two center pins, one at the top and the other at the bottom, so that it can be swung around to the outside of the booth to simplify the arrangement of the tickets in the pockets

are carried through until completed parts are delivered to finished stock.

The vehicle for all the steps in the dispatching and planning of production in the shop is a quadruplicate "production" ticket (Figure 1). A block is provided on the form for every item of information needed for shop and office control. The information is reported and recorded at different times and places, but any one fact is entered only once.

Figure 2 shows a view of a dispatch booth. The sides of the booth are banks of machine load pockets. These banks are made up of from 35 to 42 pocket units, each with a back pocket, front pocket, and spring clip. One unit is assigned to each machine. As will be explained in detail later, a set of production tickets in a back pocket represents a job or factory order calling for an operation to be performed by that machine but not available for processing at the time. When the work is available, the set of tickets is moved forward into the front pocket. When production on the machine has actually started, the tickets are placed under the spring clip. Each bank has two center pins, one at the top and another at the bottom. Thus the whole bank can be swung to the outside of the booth to simplify the arrangement of tickets.

Foreman Checks Order

When the material for a lot arrives in a department, it is accompanied by the production order which the production clerk has had checked by the foreman, obtaining his signed approval of correct operational sequence and special instructions. The order is then turned over to the timekeeper in the dispatch booth. She makes out a set of production tickets for each operation to be performed by departments controlled from her booth. The model number and part, operation number, run quantity, and run number are entered on the production ticket. From time to time, when the production clerk has an opportunity, he takes the tickets that have accumulated, turns a bank of pockets to the outside where he can conveniently reach them, assigns each operation to a machine, places the number of the machine in the square provided, and puts the set of tickets in the back pocket of the unit assigned that machine.

When an operator is ready for a new lot of work, he reports to the dispatch booth. The timekeeper takes the first set of tickets in the front pocket for the machine the man is operating and assigns the lot and operation represented by that set to him. She enters the operator's "name," "clock number," "regular department," "department worked in," "hours per 100 pieces," and "standard parts per hour." If this is the beginning of the operations on the lot, she also enters zero in the block for "previous production." She rings in the "start" time, and files the tickets under the spring clip for the machine.

At the end of each shift, or when a job is completed, the operator again reports to the timekeeper. The "end" time is rung out and his count entered in the block for "production, this ticket." At the same time he must present any tickets that have been issued to him for idle time. These are entered as "non-productive

tickets," their total time is entered as "non-productive hours," and the net actual hours are calculated and recorded. If the operation has been completed on the lot, that fact is checked in the block provided, and the first job in the front pocket is assigned to the operator, as described in the previous paragraph. If it is the end of a shift but the operation is not complete, a new set of tickets must be prepared for the man who will take over on the next shift. The set is placed under the clip with the blue copy exposed. When the next shift operator arrives and is assigned the job, the set of tickets for his machine is turned face outward. By surveying the bank, it is obvious to the foreman which machines do not have anyone assigned to them.

Entries Made on Tickets

Ticket sets are held at the dispatch booth until the work has been inspected. When scrap is found, the quantity rejected is entered after "scrap" and the set is initialed under "inspected by." "Net production" and "total to date" are then extended by the timekeeper. If the operator is to receive credit for his scrap, the accepted production will be different from the net production, and the set will have to go to the foreman for his approval to pay the employee for the work done on the items scrapped. At the same time, facts relative to "temporary standard" or "run off standard" are checked with reasons and signed by the foreman. Total to date can now be entered as previous production on the ticket set that has been prepared for the next operator.

The accumulation of production tickets for an operation gives the complete detailed history of performance. When a lot has been finished, the production clerk is notified, and he checks the final total with the production order and the actual count of the parts now ready to move to the next operation. If everything is in order, he enters the total completed for the operation on the production order. The comparison of the total to date on the tickets with the actual count of the parts and previous operations on the production order, assures absolute accuracy.

The production clerk now directs the movement of the material to the machine for the next operation and secures the set of tickets from the back pocket of the unit for the machine on which the job will be performed. He schedules the work by placing the set in the front pocket in the proper sequence, which is determined by the over-all monthly schedule or the detailed machine load.

Ticket Set Is Moved

In some cases there are a number of machines, any one of which could do the work involved in the operation. The pocket units for all are in one horizontal row, and the tickets are placed in the left-hand back pocket. When the material becomes available —i.e., passes the previous operation— the ticket set representing the order is moved into the second back pocket. They can now be distributed into the front pockets of the units for the different machines as the foreman or production clerk selects orders for machines that will soon be in need of work.

The original, yellow, copy of the production ticket is used to tabulate a daily production report on all key production centers, which is available to foremen by noon of the following day. The copies are then filed in the dispatch booth as departmental receipts and count check. The other three copies are forwarded to the production office, where they are extended on a bookkeeping machine and an operator efficiency report is tabulated. The duplicate, triplicate, and quadruplicate copies are separated as follows: The white duplicates are filed to substantiate the operator's efficiency report; the red triplicates are used for machine efficiency tabulations; and the blue quadruplicates are accumulated by lot as a progress record. When all work is completed, the tickets are checked with the order and filed as a permanent record which can be totaled for cost by lot or item at any time.

As was stated in the beginning, any item of information is recorded only once but is used for a number of functions and reports. In the first place, the ticket sets serve as a medium for visual scheduling. A glance gives a picture of the work ahead of a department, section, or machine group, and the proportion that is available for productive operations. The sequence of orders to be fabricated is indicated by the simple sorting of tickets representing the orders. Changes in plans made necessary by any number of different circumstances beyond the control of supervision, or to comply with policy decisions, can be accomplished with ease by simply sorting the tickets in accordance with the new requirements. No clerical work is required to transfer planning information to the dispatch clerk or timekeeper, and there is no delay between planning and dispatching.

With detailed instructions conveyed by the location of written tickets on the planning board, the foreman can be assured of smooth operation according to plan, even though other responsibilities call him off the job. A short time each day on concentrated planning of this type eliminates constant interruptions by follow-up men, set-up men, and operators looking for work.

System Is Simple, Visible

The simplicity and visibility of the whole procedure enable a foreman to train subordinates in that part of his responsibility, and to delegate functions to them, and also to maintain close touch and full appreciation of what they are doing.

With the extension of total to date on each ticket, the loss of a production ticket is immediately apparent. Operators have been impressed with the importance of their actual individual count, and they cooperate fully in keeping production counts accurate when they are personally responsible for the figures. Accumulated figures compared with actual counts prove that this method invites unusual operator cooperation.

Using copies of the original transaction for all calculations relative to costs, efficiency, and progress guarantees accuracy and uniformity in all records and reports.

IF YOUR COPY OF *FACTORY* IS LATE—

Be patient, please. The nation's transportation system is severely loaded. The delay may be unavoidable. Allow a few extra days before writing us. Both the publisher and Uncle Sam are doing everything they can to get your *Factory* to you on time

THIRD QUARTER PROSPECTS FOR WAR AND PEACE GOODS

SIGNS INDICATE that military procurement officers are increasingly willing to scale down their demands for war matériel toward the size of a one-front conflict. This means more rapid progress in reconversion for the third quarter of 1945 than was possible in the second. Percentages of cutbacks vary; most significant are a 50 percent reduction in artillery shells and a 30 percent cut, by weight, in output of airplanes.

Shortages of sheet steel and lumber continue to handicap resumption of civilian goods manufacture, but at mid-July there appeared some hope that supplies will be available by fall in improved volume.

Here, item by item, is the situation as regards the production of war matériel and civilian goods:

1. **Cutbacks.** Total war production should be down 15 percent by September 1. Time required for troop movements may make more rapid cutbacks possible.

2. **Controls.** WPB policy gives go-ahead to some industries sooner than others, but individual companies generally get reasonably fair starts.

3. **Materials.** Sheet steel and lumber short. Copper and aluminum relatively plentiful. Wool scarce. WPB warns against damaging effect of over-size inventories.

4. **Facilities.** Machine tool industry's output for civilians is handicapped by backlog of war priority orders, but some progress is being made.

5. **Civilian goods.** Many products authorized—some with materials earmarked. *But scheduled allocations of sheet steel leave none for automobiles.*

6. **Manpower.** Dislocated workers now about 300,000, but future hour cuts and heavy consumer demands make large unemployment in manufacturing highly improbable.

7. **Veterans.** Super-seniority and right of veterans to stay out of unions remain live arguments.

8. **Unions.** Proposed overhaul of Wagner Act is denounced by unions. Pressure continues for 40-hour week with 48 hours' pay.

9. **Prices.** Congress considering relief for manufacturers from OPA price methods.

10. **Surplus Property.** Disposals to be handled with caution rather than speed. Lease methods debated.

11. **Termination.** Expect renegotiation will be continued. Compulsory repricing may be repealed.

12. **Taxes.** Reduction of excess profits tax, and possible abolishment, gaining favor in Congress.

13. **Cartels.** Department of Justice uncertain of future course, following du Pont's acquittal.

14. **Planning.** Idea of 60 million jobs-or-doles continues popular in some political circles.

Cutbacks

IMPACT OF CUTBACKS in war goods will be felt more sharply throughout the national economy and especially in manufacturing during the remaining weeks of this summer. Total cutbacks to date in all forms of war and war-supporting production amount to about 10 percent of pre-V-E Day volume, but a steady dribble of additions is continuing—indicating that the reduction will reach or exceed 15 percent by September 1, as previously predicted.

In relation to reconversion, the most important cutbacks are those in airplanes, big guns, tanks, cargo vessels, and some sizes of ammunition. Measured by weight of materials used, output of planes is down approximately 30 percent. Artillery shells have been cut 50 percent. Precise figures on many other items are withheld, but it is not improbable that most of

the major metallic war products are down 15 to 30 percent.

Despite the substantial volume of reductions already expected, the total cuts so far "still do not bring down the war goods program to a true one-front war basis," as Chairman J. A. Krug of WPB recently pointed out to the public.

For the fiscal year beginning July 1, approximately 25 percent was pared by the War Department from the Army's budget as compared with the previous year. The new budget calls for expenditures of $39,019,790,474. Lend-lease estimates for the new fiscal year amount to $4,375,000,000 which is a drop of approximately $750,000,000.

Probably the biggest continuing influence for further cutbacks in total production of war goods will be the time lag before the Army and Navy will have assembled all the manpower they need in the Pacific zone for the final all-out assault on Japan. That will not be until large numbers of U. S. troops have been transferred from Europe—a transportation job which President Truman has verified will require 10 months. That delay, of itself, will tend to hasten additional cutbacks because, on the present basis of production, many major classes of military items will inevitably be created two and three times as fast as they are currently consumed, and certainly no one would demand that such a condition be continued indefinitely.

WPB Controls

FAIRNESS OF OPPORTUNITY, it now is evident, will be one of the basic aims of WPB policy in dealing with industry during reconversion. This does not mean, as some people have feared, that WPB will keep large segments of industry marking time until all other segments also have finished producing for war, in order to assure an equal start-off. But neither does it mean that WPB will taper off its controls in such a way as to create a lot of unfair advantages.

In general, the WPB process will allow some *industries* to reconvert faster than others, but will start off the *companies* within each industry on a fair competitive basis. For example, washing machines get a go-ahead long before radios, but washing machine companies among themselves get about as fair a start as seems to be possible. A few exceptions to the rule may possibly develop where military welfare is at stake.

Overlapping WPB's policy of the fair start will be the technique by which the go-aheads for civilian production are given. This will continue to consist of two parts: (1) Limitations on civilian production will be lifted on a broad basis—even for items that WPB does not expect to be produced in quantity for a long time to come; (2) the prime claims of war goods production to raw and semi-finished materials will provide a remaining limitation on total civilian production even after the direct limitations have been lifted.

Although the practice of spot authorization for civilian production has been virtually ended, WPB will continue to help manufacturers of importantly needed civilian goods get the materials ahead of makers of non-essential goods. Food machinery, washing machines, and refrigerators are typical of items in the preferred category. But preferential treatment will not mean that the recipients will get all the materials they want. They will get on priority just enough to produce certain quotas of their products. If they want to produce more, they will have to seek materials without priorities.

Also WPB will continue to allow priorities for tools and equipment for reconversion of industry.

Materials

EFFECT OF CUTBACKS in war production is beginning to show up increasingly in terms of increased availability of some raw materials such as aluminum and brass, but is having slow effect upon the availability of steel, especially sheet steel. WPB says this is partly because some manufacturers have been slow to cancel sheet orders, partly because some are negligent in turning back leftover quantities, and partly because some sheet is in incoming "pipelines" when cutbacks are received and cannot be easily diverted.

Says John D. Small, chief of staff of WPB:

"It is our present intention to take effective action against those who violate our regulations by receiving materials and components to which they are not entitled, or who accumulate excessive inventories."

WPB will handle its check of inventories in a matter somewhat similar to its audits under the Controlled Materials Plan, Small says, but adds:

"In those instances where WPB's inventory controls might hamper reconversion, we are modifying them in such a way as to permit acquisition of reasonable inventories for resumption or expansion of non-military production."

Percentages of some materials that have become available for civilian use, notably aluminum, are greater than the over-all rate of war goods cutbacks. Others, such as tin, will remain on the critical list for months; possibly until the war is over.

Outlook and present status of principal raw materials is as follows:

Steel. More steel plate capacity available than can be currently used, but not enough sheets. Changeover of some continuous mills from plates back to sheets has started but will take several weeks' time and nearly $200,000,000 to do the job. After allowance for first claims of military requirements for steel sheet in the third quarter, all of the remainder—about 1,000,000 tons—will be allocated to Class B groups which consist of washing machines, freight cars, refrigerators, battery containers, and similar items, mostly of a semi-war use or war-supporting nature. *So far as the WPB schedules show, no sheet remains for automobiles, which will require 170,000 tons, but WPB believes nevertheless that the automobile industry somewhere will fill its needs—and without priorities.*

Aluminum. Don't be surprised if some automobile makers turn to aluminum for many parts such as hoods to expedite production of cars. Makers of a number of

WPB'S BOTTLENECK PRODUCTS AND MATERIALS

Shortages of various degrees among these 101 items are listed officially as bottlenecks at the present time to some phases of war-supporting production and to high-urgency civilian production programs

Antimony
Antimony oxide
Asbestos textiles
Axles, automotive truck only
Bellows assemblies, metallic precision
Benzene
Benzyl bensoate
Bismuth
Bismuth chemicals
Bristle, hog
Burlap
Cadmium
Cadmium oxide and plating salts
Capacitors, ceramic, dry electrolytic, and paper dielectric
Cattle tail hair
Chain, power transmission (except silent)
Cloths, industrial wiping
Coal, anthracite and bituminous
Containers, all kinds
Controls, temperature and combustion
Cordage
Cotton broad woven goods
Cotton sales yarns
Cresols and cresylic acid
Dental burrs
Distillates, military and essential civilian specifications
Dishwashers, commercial type
Emetine
Engines, internal combustion, air cooled diesel, liquid cooled
Freight cars
Gasoline, aviation
Hydrogen peroxide
Iron oxide, yellow
Kapok
Laboratory equipment
Lead
Leather Group
  Cattle hides and leather
  Goat, kid, and cabretta
  Horsehides and leather
Lumber, sawed and cross ties
Mica, certain grades
Motors, electric, fractional horsepower
Motors, electric, integral horsepower, a.c.
Napthalene
Napthenic acid
Netting, camouflage and fish
Nicotine sulphate
Nylon
Oil, crude
Petroleum sulfonates (refined oil soluble)
Photographic paper, certain types
Phthalic anhydride
Pipefittings and unions, malleable iron
Platinum
Plywood, softwood
Pulp, sulphate
Pulpwood
Quinacrine
Quinidine
Radar, airborne
Radiation, cast iron
Resistors, fixed; molded composition and wire wound, 25-watt
Rosin and certain resins
Rubber Group
  Butyl
  Certain mechanical rubber goods
  Fire hose, cotton rubber lined
  Natural and latex
  Neoprene
  Polyisobutylene
  Reclaimed
  Rubber processing machinery
  Scrap
  Tires, pneumatic truck
Screen cloth, insect, metal
Sodium bichromate
Soil pipe, cast iron
Socks, men's work
Steel and Alloys Group
  Chrome metal, including nonferrous chromium bearing alloys
  Columbium
  Low carbon ferro chrome
  Nickel
  Seamless pipe and tube
  Steel sheet and strip
  Wire, fine gage, high carbon
  Wire nails
Switchgear, metal clad, high and low voltage, including circuit breakers air, oil and air blast
Talc, fibrous
Textile machinery
Tin
Tire cord, cotton and rayon
Transformers, power distribution
Transmissions, automotive truck only
Trucks, industrial fork lift, gasoline driven
Tubes, radio receiving types
Underwear, heavy
Valves, iron and steel lubricated plug
Valves, bronze, 100 pounds S.W.P. and over
Wax, micro crystalline
Wax, paraffin
Wool, broad woven goods
Wool top
Work gloves, mittens, and clothes
X-ray film

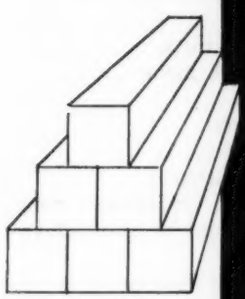
other products may make also increased use of aluminum for cabinets. More than 100,000,000 pounds of this metal has been released by WPB on a non-priority basis for the third quarter. Open-ending probably will be still larger by the time the fourth quarter arrives.

Copper and Brass. Military requirements have been reduced so much that approximately 550,000,000 pounds of copper and brass will be available in the open market during the third quarter. In addition, some 560,000,000 pounds has been allotted to Class B products, which include a number of parts or finished products for civilian items—for example, wire for electric motors.

Wood. Lumber will continue to be a bottleneck, but some relief is in sight for containers, paper, and other wood-pulp products from expected shipments of pulp from Sweden in Swedish ships. Some easing of lumber supply also will result in the fourth quarter from a lessening of lend-lease exports to Europe and the increased availability of lumber in the Philippines. Present biggest use of lumber is for crating and boxes, now at the rate of about 15 billion board feet per year, and this also should decrease almost proportionately to decreases in the total shipments of war goods. For the third quarter, WPB will play safe, hold plenty in reserve.

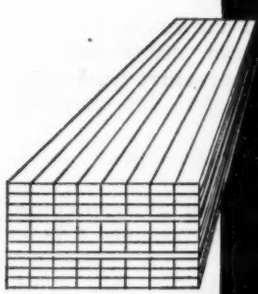
Fuel. Supplies of coal and oil for the third quarter, and to a greater extent for the fourth, continue to give cause for worry. Increased reliance on warships and big bombers, plus the long distance for increased shipments

HOW MATERIALS LIMIT C



FINISHED STEEL (Tons)

16,000,000		
500,000	3rd QUARTER 1945	←
1,000,000	4th QUARTER 1945	←
10,000,000		



LUMBER (Board Feet)

7,950,000,000		
1,283,000,000	3rd QUARTER 1945	←
1,600,000,000*	4th QUARTER 1945	←
6,500,000,000		

WOOLEN and WORSTED APPAREL FABRICS (Yards)

105,000,000		
50,000,000		
55,000,000*		
120,400,000		

BASED ON WAR PRODUCTION BOARD DATA

*UNOFFICIAL ESTIMATE

CIVILIAN PRODUCTION

1945 ESTIMATED 3rd QUARTER PRODUCTION

AVAILABLE WITHOUT PRIORITY

In addition, 4,000,000 tons of steel has been allocated in the third quarter of 1945, and probably an equal or slightly greater amount will be allocated in the fourth quarter, for Class B goods which consist of certain civilian items and war-supporting products

1939 QUARTERLY CONSUMPTION RATE

1945 ESTIMATED 3rd QUARTER PRODUCTION

AVAILABLE ON ALLOCATION

Civilians' total includes 349,000,000 board feet allotted to National Housing Administration, 422,000,000 allotted to War Food Administration, and roughly 513,000,000 (approximately 10 percent) of total allotment to industry. In addition, 1,328,000,000 board feet is held under WPB control as emergency reserve

1939 QUARTERLY CONSUMPTION RATE

1945 ESTIMATED 3rd QUARTER PRODUCTION

3rd QUARTER 1945

4th QUARTER 1945

AVAILABLE (80% REQUIRES PRIORITY)

1939 QUARTERLY CONSUMPTION RATE

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of supplies in the Pacific, will leave American industry and civilians just about as hard pressed for fuel this winter as last.

Other Materials. Those available in improved quantities will include zinc and lead. Cotton and wool textiles will continue as bottlenecks. Rubber will be adequate for needs, although inadequate for demands. Tin and several metallic alloys continue as major shortage items.

Facilities

OPEN PLANT FACILITIES for reconversion to civilian goods are not now as great as cutback proportions would indicate. In numerous cases cutbacks have simply reduced plants from a two-shift to a one-shift basis, rather than freeing them fractionally for production of civilian goods. In other instances, such as Willow Run, the building is available but there is no civilian project at this stage that is suitable to use it.

Biggest reconversion problem of facilities, however, is in machines and tools, rather than plants. Present production of machine tool industry is around $39,000,000 a month, but with a backlog of $130,000,000 in war orders it is a question how fast the machine tool builders can "sandwich in" $90,000,000 in orders for reconversion. There are about $40,000,000 in reconversion orders for the automobile industry alone.

In addition, orders are on hand for $80,000,000 in tools for Russia, which at last reports were still marked AA-1. It is considered likely, however, that the Russian orders will be reduced in priority, or removed entirely from any priority class.

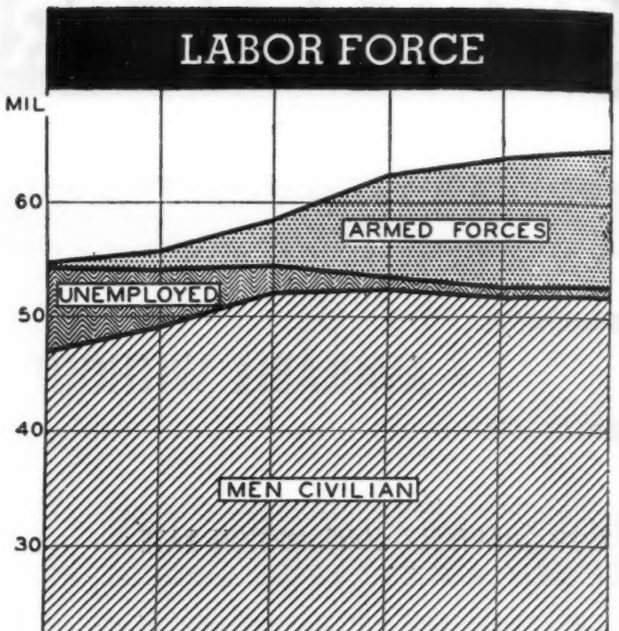
What is worrying the machine tool industry most is that it has only an AA-3 rating for materials and supplies to make the reconversion tools for the rest of industry.

One hopeful prospect comes from various forms of cooperation among manufacturers who are trying to help one another, offering unused machines for sale, or otherwise making their facilities available. Best prospect comes from the machine tool builders' privilege to go on reconversion items at any time they temporarily catch up with war order schedules. This permits some tool building facilities to be used for short periods on reconversion orders. It is not ideal, but it is making some progress.

Civilian Goods

IT WILL NOT BE LONG until the Great American Consumer begins to see new products on the market of a type that for the last several years have been conspicuous only by their absence.

Numerous kinds of small home appliances such as electric flat irons will lead the way. But close behind them will be a modest flood of other items including at least 155,000 washing machines and 227,000 mechanical refrigerators in the third quarter, and 691,018 new automobiles between July 1, 1945, and March 31, 1946.



In considering reports on the manpower situation it is well to have an over-all picture of the labor force. The Cleveland Trust Company has done a particularly good job in dramatizing the labor data. We reproduce herewith the chart appearing in its *Business Bulletin*

Production of many of the items including automobiles will depend upon the success of their respective manufacturers in getting materials without priorities. In the case of washing machines, refrigerators, and a few other items, however, WPB will give priorities for the materials required—up to the quota limits.

Ten automobile companies are allowed varying quotas of production. General Motors is to build 285,288 cars; Chrysler, 148,905; Ford, 119,730; Studebaker, 27,820; Hudson, 21,602; Packard, 20,118; Nash, 19,550; Willys-Overland, 16,000; Graham-Paige, 16,000; Crosley, 16,000.

The production of washing machines will be divided on a quota basis among General Electric, Bendix, Maytag, Automatic Washer, Dexter, Appliance Manufacturing Company, Zenith Machine Company, One-Minute, Westinghouse, Norge, and Landers, Frary & Clark. Quotas for mechanical refrigerators will be assigned to Frigidaire, General Electric, Kelvinator, Sears-Roebuck, Servel, Norge, Westinghouse, Philco, and Ranney.

Some quotas are slated to be raised in future weeks. The third-quarter quota for washing machines probably will wind up at not less than 350,000.

Considerable turmoil remains concerning the pros-

pects of numerous other forms of civilian goods. Neither cotton nor woolen goods output is expected to ease materially in less than six months.

There are good prospects that home building for civilians may take a considerable upturn by the final quarter of this year. At the present time, however, about 37,000 units a month are being authorized under the H-2 and H-3 programs of the National Housing Agency. This means that home building will shortly be at about one-third speed. Individual structures, however, are limited by an $8000 ceiling and by restrictions on materials.

Manpower

EMPLOYMENT in the manufacturing industries now is roughly estimated at about 300,000 less than on V-E Day. Largely, however, this decrease represents workers who have hesitated to move to new localities where other jobs are waiting, or who are voluntarily taking a week or two to "look around"—hoping to find new jobs with wage standards comparable to war-boom industries.

Much talk continues about the possibilities of large numbers of unemployed at some future date. But most of such conversation counts in large numbers of temporary war workers who never intended to keep on working after the war is over. It also overlooks the cushioning effect that a reduction of average hours to the 40-hour week will have as war production gradually tapers off. This alone will be equivalent to the absorption of about 10 percent of present factory manpower. Finally, the big unemployment talk overlooks the tremendous pent-up desire and ability of consumers to buy homes, automobiles, and a thousand kinds of other products—a market that can keep manufacturing at top blast for at least 10 years to come.

Only two potential hazards to an orderly and painless readjustment of manpower are: (1) The remote possibility of sudden and unexpected surrender by Japan—which would hit industry with a deluge of cutbacks; and (2) strikes and other disturbances fomented by radical leaders of labor.

Russian entrance into the war against Japan also might lead to a rather rapid reduction in the size of U. S. armed forces, but rather than causing unemployment, this should tend to hasten reconversion.

Veterans

HOTTEST POINT OF CONTENTION over "super-seniority" for veterans of the present war may prove to be the question of the rights of such ex-servicemen to displace veterans of the First World War. A number of such cases have already arisen, with old veterans having long seniority losing out to young veterans supposedly with the law behind them. Conflicting answers to the tests are still being argued.

Another pending veterans' employment subject concerns a bill by Representative Rankin to "protect honorably discharged veterans in their right to join or refrain from joining labor and other organizations." Consideration on this was deferred by the House Committee on World War Veterans Legislation pending further consultations between the Administrator of Veterans Affairs and representatives of the labor unions.

Unions

THE NATIONAL LABOR RELATIONS ACT, which for the last 10 years has given union organizers tremendous power to force all workmen to join unions, and tremendous power to dictate terms in collective "bargaining" with management, now faces what is probably the greatest challenge of its legalistic life. This challenge to the Wagner Act comes in the form of a new labor relations bill introduced in the Senate by Senators Carl A. Hatch, Harold H. Burton, and Joseph H. Ball. It provides for:

1. Arbitrating all disputes affecting public utilities or services such as milk, coal, or oil.

2. Barring strikes and requiring arbitration in any grievance disputes arising out of differing interpretations of labor-management contracts.

3. Retaining the Wagner Act's ban against unfair labor practices by employers, but adding a similar ban against unfair practices by labor.

4. Modifying the Wagner Act's provision for closed shops, so that a closed shop would be denied unless it were favored by a union representing 75 percent of all employees involved, and unless the closed shop were ratified by 60 percent of the individual employees involved, and unless the union admits any qualified person to membership, and unless no member may be deprived of membership except on written charges and after a fair hearing.

5. Defining more strictly the application of the law to interstate business.

6. Directing a new labor relations board of five members to survey the possible need for legislation to make unions more democratic.

In another section, the bill provides for the set-up of the five-man board with enormous powers over the mediation, conciliation, and adjustment of labor disputes. The bill also provides for a three-man tribunal to administer the board's judicial functions.

The bill would exempt from its provisions all companies having fewer than 20 employees.

No sooner had the bill been announced than it was denounced both by Philip Murray of CIO and William Green of AFL. Murray said, "It tears the heart out of the Wagner Act." Green particularly criticized the provisions for compulsory arbitration which he said "the wage earners of America never will accept."

There was no immediate comment from Lewis B. Schwellenbach, the newly designated Secretary of Labor, or from Paul M. Herzog, newly appointed chairman of the present NLRB.

Pressure is mounting in several quarters to pave the way for higher wages. Both the CIO and AFL have participated in a recent new flurry of arguments to

persuade the Congress and President Truman that higher wages should be allowed than are permitted by the Little Steel formula. The President replied that the formula would stand at least until after a thorough investigation of wages in relation to commodity prices.

William H. Davis, Director of Economic Stabilization, also has been urging a 50-cent-an-hour minimum for the National Fair Labor Standards Act, with a minimum of 65 cents in some special cases. The present floor is 40 cents.

Further contributing to the wage issue was a statement by Theodore W. Kheel, executive director of WLB, reminding employers that the board is satisfied that its powers include controls over downward wage trends as well as those that are upward.

On the other side of the picture, George W. Taylor, national chairman of WLB, said. "We figure the amount paid the average employee for an hour's work at straight time has increased more than 36 percent." This compares with a "30 percent increase in the cost of living."

Prices

EFFORTS to give manufacturers relief from certain price control methods of the OPA may be debated in Senate and House for some weeks to come, with no indication at this time of the final result. Under terms of an amendment to the Price Control Act proposed by Senator Taft the OPA would not be permitted to establish "over protest" any maximum price after October 1, 1945, on any commodity which did not return to the manufacturer or processor at least the equal of the dollar margin over cost of production which was received during 1941.

Surplus Property

DISPOSAL of surplus war property, it now seems certain, will be characterized more by caution than by speed. Sales of plants and capital equipment must proceed carefully, Alfred E. Howse, SPB Administrator, asserted in a report to Congress. He estimated that the total of surplus goods would amount to possibly $100,000,000.

Senator Tom Stewart warned that, unless unusual care is applied, the disposal of surplus may wind up as another Teapot Dome scandal. Former Senator Guy M. Gillette, retiring chairman of the Surplus Property Board, told a Senate committee that he opposes the leasing of U. S.-owned plants, but a Justice Department report to Congress recommends leasing as a means of encouraging small business ventures.

Termination

SOME BELIEF IS EXPRESSED in Washington circles that Congress may repeal the legislation that now provides for compulsory repricing of war contracts, but will continue legislation for the renegotiation of war contracts until the end of December. Proposals to modify or repeal the repricing law have been stoutly opposed by the War and Navy Departments.

The Supreme Court will review the constitutionality of the renegotiation act. The review was asked by the Mine Safety Appliances Company, Pittsburgh, which sought to keep the government from recovering more than $1,000,000 on a war contract.

Taxes

PROPOSALS for ending the excess profits tax as soon as Japan is defeated, are getting many sympathetic ears in legislative circles in Washington. At least one bill for such action will be offered in the House as an amendment to the five-point tax program introduced by Representative Doughton, chairman of the Ways and Means Committee.

Doughton's bill, with Administration support, proposes raising the exemption from the excess profits tax from its $10,000 level to $25,000. This, he estimates, would increase by $160,000,000 the cash reserves of corporations in 1947. Among other features it would give business permission to take the post-war credit of 10 percent of the excess profits tax currently, in favor of tax bills for 1944 and subsequent years.

Cartels

ACQUITTAL of E. I. duPont de Nemours & Company, Rohm & Haas Company, and six individuals on cartel charges brought by the Department of Justice has left the department uncertain of its future course of action, according to Wendell Berge, Assistant Attorney General in charge of anti-trust prosecutions.

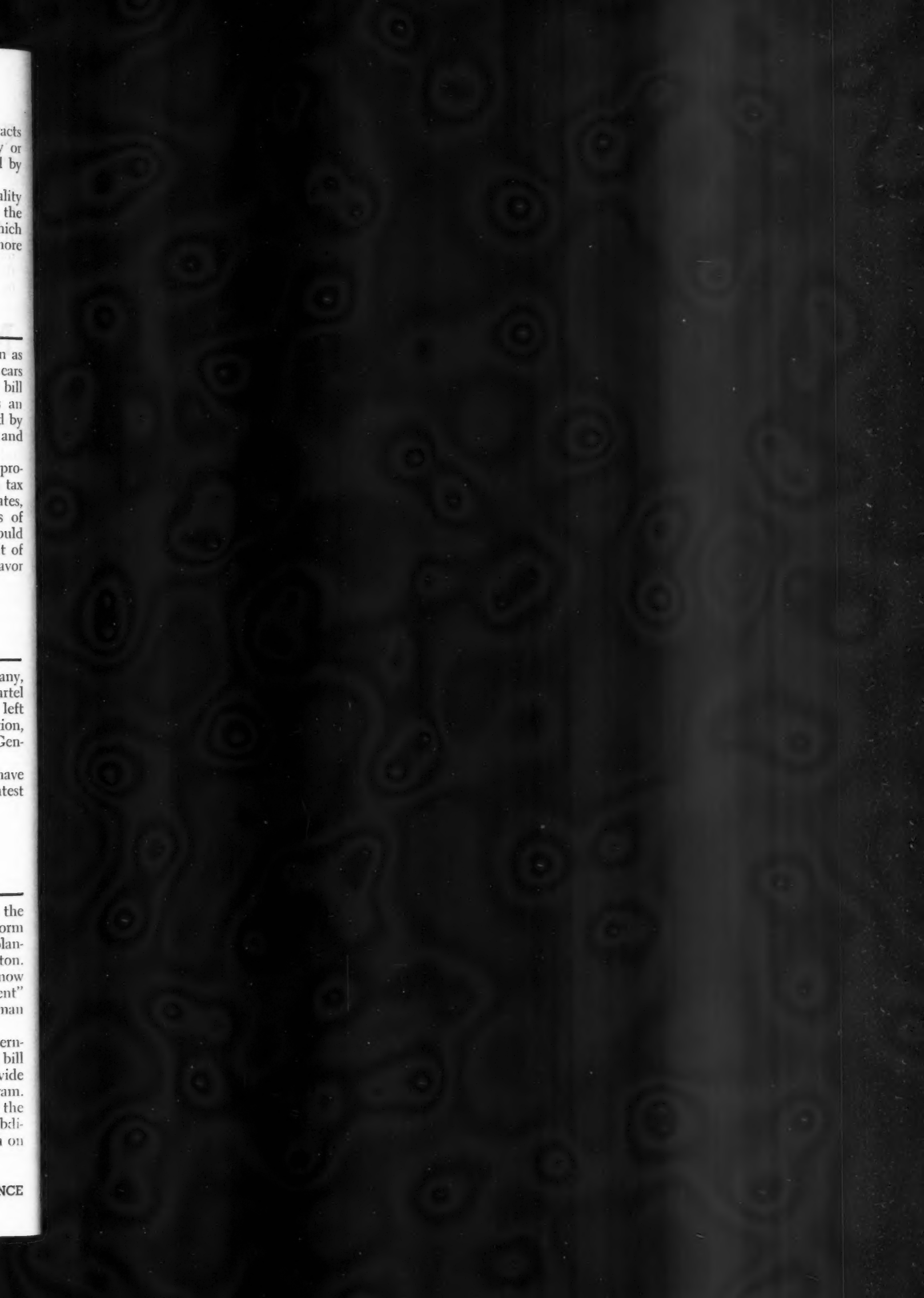
Berge said, however, that his ideas about cartels have not changed and that he still regards them as "the latest and most sinister form" of monopoly.

Planning

THE IDEA that there are 60,000,000 persons in the United States who either should have jobs or some form of governmental dole still pervades the post-war planning of some segments of officialdom in Washington.

Fred M. Vinson, Director of War Mobilization, now is listed as a full supporter of the "full employment" bill which is being pushed by Representative Patman and Senator Murray.

To some extent, similar thinking about the government's possible role in making work is involved in a bill introduced by Senator Thomas of Oklahoma, to provide for a $6,000,000,000, three-year public works program. A billion dollars yearly would be appropriated by the federal government. States and lesser political subdivisions would be required to match the federal sum on a 50-50 basis.



DISCIPLINE

A case study in the development and application of a discipline procedure

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KEY TO GOOD DISCIPLINE at the Bendix Radio Division of Bendix Aviation Corporation, Baltimore, is the fostering of a "let's talk it over" attitude on the part of supervisors and employees. It is this spirit that is mainly responsible for the success of a discipline policy and procedure developed and installed some eighteen months ago.

Like many other firms, Bendix Radio's procedure governing the administration of disciplinary measures had consisted of a list of some fifteen to twenty offenses in the employee's handbook, with the warning that commission of some offenses would result in immediate discharge, whereas commission of others would result in other disciplinary action. There was no definite specification of what the "other" disciplinary action might be.

As in other companies, those authorized to discipline employees for infractions of regulations were expected to be fair and consistent in their actions and decisions. Three controls were used to protect employees in case this expectation turned out to be incorrect and the disciplinary measures appeared to be inconsistent or unfair. These controls were:

1. The grievance procedure
2. "Exit" interviews, covering all terminations, including discharges
3. Counselors (in some departments)

Fortunately the company was, and is, blessed with an excellent group of supervisors. As a result, the number of "reversals" due to grievance hearings or investigations arising out of exit interviews at no time reached disturbing proportions. Also, cooperation with counselors was very good indeed, so that much healthy clearing up of potential problems was taken care of through the joint efforts of supervisors and counselors.

However, weighing against these favorable conditions within the organization, there were certain factors that made the orderly administration of disciplinary measures a difficult problem. One factor was mere geographical distance, caused by the existence of a number of plants each of which was separated from the others by several miles. This made the coordination of supervisory effort more difficult than would have been the case with all operations under one roof. In addition, employees in all the plants were part of one bargaining unit and were represented by the same union. This condition tended to make more evident than otherwise would be the case such inconsistencies as did occur. As a result, from time to time conscientious and thoughtful supervisors raised questions in supervisory conferences or in face-to-face discussions that indicated a need for review of the company's discipline policies and procedures.

Step 1: A Survey of Supervisory Opinion

About a year and a half ago, an informal survey was made of the key supervisors and the major department heads (top operating executives) of the company in order to determine their reactions to the discipline policy that existed at that time. The survey

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Only three forms of discipline are recognized at Bendix Radio—discharge, oral reprimand, written reprimand. Discharge is mandatory for a limited number of offenses, optional for others (see listings in statement of policy, pages 100 and 101). Responsibility for maintaining discipline is the foreman's. Every discharged employee has the right to have his case reviewed, as in the termination interview depicted here. If he fails to get satisfaction, he has recourse to the grievance machinery

was conducted entirely on a personal contact and discussion basis. The following requirements of a satisfactory disciplinary procedure were thereby uncovered and served as guideposts to the formal policy that was later outlined:

1. Make discipline consistent. It was almost unanimously agreed that merely setting up a list of "punishable offenses" was not a sufficient guide to enable those administering disciplinary action to be sure that they were acting with reasonable consistency, when compared with others. The lists were admitted to be fine for major offenses where discharge was obviously the only course of action, but they did not help in the case of less serious offenses. Since the less serious cases were outstandingly more common, the chances of inconsistency were greatly increased. Many examples were given of embarrassing inconsistencies. The following is one actual case:

"The plant was scheduled to work on a certain July 4, as usual. Supervisors in a number of departments that were particularly rushed were especially requested not to excuse any employees for the holiday except under *proved* conditions of extreme emergency. It happened that one employee in each of these departments asked for the day off for reasons merely of personal convenience. In both cases the requests were denied and the reasons for denial explained. In both cases the employees did not report for work on the holiday. The next day one employee was immediately discharged by the departmental supervisor, whereas the other employee received only a mild 'talking to.'"

The occurrence of such inconsistent and embarrassing situations was heartily deplored by all supervisors and department heads.

2. Make discipline constructive. It was also agreed that steps should be taken to insure that discipline would be more constructive. Not one person stated that it was desirable to look upon disciplinary action just at a matter of "punishment." However, it was readily admitted that this fundamental point can easily be forgotten, with the result that little effort is exerted to correct the conditions that led to the need for disciplinary action.

The way in which the disciplinary layoff was used is a good example of a largely "punishment" form of discipline. Quite a number of supervisors used this method because they felt it to be severe enough to impress the employee with the seriousness of his offense and with the importance of avoiding a repetition of the offense. Experience indicates, however, that the outstanding result of the method is not what is mentioned above, but, on the contrary, definite feelings of dislike and bitterness on the part of the employee toward the supervisor and the company. This is particularly true where the laid-off employee is supporting a family, because the punishment hurts the family at least as much as it does the employee.

3. Protect the supervisor. It was pointed out that something should be done to protect the supervisor more adequately. Foremen and assistant foremen in particular reported that they found themselves embarrassed, in cases of grievance over disciplinary ac-

tion, because they often could not produce documentary proof of their stories. Those who kept their own records on an unofficial basis were concerned over the possibility of misunderstanding and consequent slighting references to their "gestapo" methods, "little black books," and the like. It was felt that there would be no such trouble if a uniform procedure for documenting discipline cases were set up and used by everyone.

4. Protect the employee. Company executives also pointed out that something should be done to protect the employee more adequately. Employees, it was agreed, often justly complain that they are not told about their shortcomings or violations of regulations and therefore are not given a chance to improve. They do not enjoy being forced eventually to air their troubles through the grievance machinery, but have no other course of action if supervisors are not frank and honest with them. The consensus was that, except in cases of extremely serious offenses, no disciplinary action should be permitted to take place until the supervisor had actually talked the situation over with the employee.

5. Protect the company. Company executives were also in full accord on one further point—namely, that something should be done to protect management more adequately. It is difficult to offer adequate defense against charges of discrimination, unfair labor practices, coercion, and the like, unless reasonable disciplinary consistency can be shown to exist and unless disciplinary measures can be supported by documentary evidence as needed. It is particularly important, in all cases of discharge, to be able to supply concrete evidence proving that discharge was for good and substantial reasons rather than, as one example, for union activity. Those familiar with the care and thoroughness of a National Labor Relations Board investigation know how essential it is to have well-formulated policies and well-documented records.

If the offense is not one that calls for either mandatory or optional discharge, one or more oral warnings may be given by the foreman. It is the latter's responsibility to point out the specific nature of the offense and discuss in detail with the employee the correct course of action to be followed in the future. It is to the fostering of this "let's talk it over" attitude that much of the success of Bendix Radio's discipline policy and procedure must be attributed

Step 2: A Statement of Policy and Procedure

After determining the general "guideposts" that have been outlined above, a formal statement of policy and procedure was prepared. This statement, together with the form that was developed to accompany it, will be found in the exhibits on pages 100, 101, 102.

The basic thinking that went into the establishment of the finished statement of policy and procedure was in accord with the following three fundamental points which, the writers feel, should be regarded as pertinent to any discipline procedure:

1. Discipline cannot be administered on an entirely routine basis. In order to permit consideration to be given to the circumstances of each individual case, the number of rigid and inflexible regulations must be kept at an absolute minimum.

2. No procedure can be effective if the basic rules and regulations that have been set up are arbitrary or illogical. As an example, smoking was forbidden in all washrooms and restrooms because of the fire hazard involved and for no other reason. All of the rooms affected were thoroughly modern and completely fireproofed. When this was pointed out, by general agreement the "no smoking" regulation was withdrawn for the reason that it was obviously illogical—and, incidentally, almost impossible to enforce.

3. Too much must not be expected from any procedure, in and of itself. A discipline procedure is merely a statement of a uniform method whereby violations of certain regulations are dealt with *in order to prevent recurrence of the violations.* The vast majority of employees never violate company regulations, provided that the regulations are sensible. *Maintaining the morale, job satisfaction, and cooperation of this vast majority is "discipline" in the broadest and truest sense of the word.* This is not

DISCIPLINE—

In order to protect the interests of the employees and the management of the division, certain reasonable rules and regulations are necessary. Once established, such rules and regulations will be obeyed by the great majority of employees. Unfortunately, however, there always appears to be a small minority of employees who violate the rules and regulations. The following policies and procedures are applicable to the disciplining of such individuals and apply to *all* employees of this division:

I. The division recognizes only three forms of discipline:
   A. Discharge (1) Mandatory (2) Optional
   B. Written reprimand
   C. Oral reprimand

II. Mandatory Discharge

Immediate discharge is mandatory in the following cases, provided that guilt is clearly established, and that the violation takes place on the division's premises and/or during time for which the employee is paid:

A. Drunkenness

B. Fighting or attempting to injure others (the aggressor only)

C. Stealing from the company or any employee

D. Immoral behavior

E. Unauthorized possession of weapons

III. Optional Discharge

In the following cases the seriousness of the violation may vary. Therefore, in some instances immediate discharge may be warranted while in other cases one written warning prior to discharge may be indicated. Repetition of any of the following offenses after one written warning has been given makes the discharge of the offender mandatory provided that the violation takes place on the division's premises and/or during time for which the employee is paid:

A. Willful destruction of division property

B. Willful insubordination

C. Gambling

D. Falsifying time cards and time tickets

E. Refusing to accept job assignments

F. Unless previously excused, absence for a period of three working days without notification to the personnel department

IV. All other offenses* such as:

A. Defacing division property

B. Violation of safety rules

C. Lateness

D. Absenteeism

E. Horseplay—practical joking

F. Obscene language

G. Smoking in "No Smoking" areas

H. Unsatisfactory work

shall be handled as follows:

1. One or more oral warnings may be given to the employee by the foreman or supervisor. It is the foreman's responsibility to point out the specific nature of the offense and discuss in detail with the employee the correct action to be followed in the future. At the discretion of the foreman, any number of oral warnings may be given depending upon the attitude of the employee and the foreman's judgment of the seriousness of the offense.

* These items are intended merely as examples and should not be considered to be a complete listing.

accomplished in the main by procedures or by rules and regulations, but rather by the combined day-by-day interest, effort, and humanity of all of management.

Seen in proper perspective, a discipline procedure as such does not "maintain" discipline at all, so far as most workers are concerned, because the procedure is not needed for them. In view of this, the development of a formal procedure should not be permitted to obscure the importance of a sound set of industrial relations policies as determiners of discipline.

Deciding what forms of disciplinary action to permit and what to prohibit is a basic policy problem. After much consideration only three disciplinary measures were selected for inclusion in the final statement of policy and procedure:

1. Discharge (either mandatory or optional)

2. Written reprimand

3. Oral reprimand

Many other measures were critically examined. Among these were such items as layoffs, assignment to nonbonus jobs, "fines," reduction of opportunity to earn overtime, and transfers to less desirable shifts or types of work. Aside from the fact that these and other related methods involve many dangerous legal pitfalls, it was felt that the approach throughout was so obviously a "punishment" approach that a constructive outcome could not be counted upon as a probability. In addition, it was strongly felt that too many different forms of disciplinary action would be very confusing to all concerned and would tend to foster inconsistency.

The final thought upon this matter was that only the three types of action listed above would be permitted, and that, of the three, only the oral and the written reprimand could be considered to be constructive.

Discharge is the "capital punishment" of industry. Basically it indicates either that all constructive attempts to salvage the employee concerned have failed, or that the company does not desire to try to salvage the employee. Its merit lies in the fact that it relieves the company of

A Statement of Policy

2. If the foreman or supervisor feels oral warnings have been, are, or would be ineffective or insufficient in view of the attitude of the employee and/or the nature of the offense, a written warning shall be prepared as described below.

3. Written warnings shall be prepared in triplicate by the foreman or supervisor on Form BRM 1592 (Employee Warning).

This form shall be signed by both the foreman or supervisor and the employee. If the employee refuses to sign, the foreman shall write in the space for the employee's signature "Employee refuses to sign." The original of Form BRM 1592 shall be sent to the personnel manager, who shall place it in the employee's folder, one copy shall be given to the employee, and the other copy shall be retained by the foreman or supervisor.

4. If an employee who has received a written warning takes exception to it, he shall have five days in which to initiate action under the grievance procedure. If no such action is taken within five days, it will be assumed that the employee has acknowledged that the warning was justified.

5. In the event that the grievance procedure results in the vindication of the employee, all copies of the warning shall be destroyed and the employee shall be reinstated.

6. Employees who receive two written warnings for the *same* offense may be discharged upon receipt of a third written warning for that offense. Employees who receive four written warnings for *various* offenses may be discharged upon receipt of a fifth written warning for any type of offense.

8. Each written warning shall expire as a basis of possible discharge six months after the date of initiation, but shall be kept in the employee's folder.

8. In case of doubt as to whether or not an oral warning was given, the word of the foreman or supervisor shall be taken. In cases of doubt as to whether or not written warning was given, the files of the personnel department shall be taken as final authority.

9. A foreman or supervisor has the authority to discharge an employee only from his department, and only with the approval of his major department head. Every employee who has been discharged will receive a termination interview in the personnel department. If at this time the personnel manager concurs with the action of the department, the employee shall be discharged from the employ of the division as well as from the department. If the personnel manager does not concur with the action of the foreman or supervisor, the case shall immediately be reviewed with the department head. As a result of the review, the employees shall be either discharged, reinstated, or transferred to another job in that or in some other department. No discharge becomes final until approved by the personnel department and the general manager.

10. If the discharged employee fails to receive satisfaction during his termination interview, he has the right to carry his case through the grievance procedure. Such a grievance must be initiated within five days of discharge.

11. All wages and/or salaries due to discharged employees shall be paid upon discharge.

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the presence of a problem, and, if used sparingly, it may exercise some deterring effect upon others who might be tempted to violate certain types of regulation. On the other hand, there are also certain definite drawbacks associated with discharge:

1. It is an expensive technique, since the entire costs of hiring, inducting, and training of the employee must be sacrificed.

2. It tends to lose what little deterring effect it may have if used promiscuously.

3. It is always an "unknown quantity" from an industrial relations standpoint in that each new case may contain all the incendiary elements necessary to lead to legal proceedings or other disruptive action.

In contrast with the above points, the methods developed for using oral and written reprimands have shown a number of definite advantages to the company. The more important are:

1. In every instance the supervisor must discuss the alleged offense with the offender. This procedure encourages more frank and open everyday working relationships.

2. In the case of the written reprimand, the offender must acknowledge the justice of the reprimand or must challenge it within five days. This is a good guarantee against hidden grievances "dragging on" for a long time.

3. Since copies of written reprimands must be signed by the supervisor and sent to the personnel department (as well as given to the person involved), it is difficult for any action to get very far if it will not stand close scrutiny. This is of joint benefit to all concerned—the employee, the supervisor, and the company.

4. The number of written reprimands gives the employee an accurate indication of the seriousness of this situation. He knows just where he stands and how many "chances" he has before the ultimate action of discharge can be expected.

5. Putting a 6-month time limit on the effective life of a written reprimand sets up a constructive goal for

an offender. He knows that he always has a chance to "wipe the slate clean" and there is abundant evidence that he tends to respond favorably to such an obviously fair arrangement.

The degree of specificity used in listing the offenses for which disciplinary action should be invoked determines the amount of discretion allowed to those authorized to administer discipline. Generally, the greater the specificity, the less is the discretion allowed. In view of this, much attention was devoted to this problem.

The first conclusion was that it was impossible to develop a listing of offenses that entirely eliminated discretion and judgment. The main reasons for this conclusion were:

1. It is impossible even to identify or classify an offense without introducing a definite judgment factor.

2. Frequently there is also a problem of judgment and discretion involved in identifying which person in a group is guilty of the alleged offense.

3. A minor offense, repeated a number of times, may begin to assume serious proportions. This is strictly a matter of judgment.

EMPLOYEE WARNING

(To be filled out in triplicate)

Name: _____ Clock No. _____ Date _____

REASON (check)

- Willful destruction of Division property ☐
- Willful insubordination ☐
- Gambling ☐
- Falsifying time cards and time tickets ☐
- Refusal to accept job assignments ☐
- Absenteeism ☐
- Lateness ☐
- Defacing Division property ☐
- Violation of safety rules ☐
- Horseplay—practical joking ☐
- Obscene language ☐
- Smoking in "No Smoking" areas ☐
- Unsatisfactory work ☐

OTHER (specify): _____

Date of Infraction: _____ Place: _____

Witnesses: _____ _____

Names of others involved: _____

_____ _____

Details: _____

_____

_____

_____

_____

_____

_____

Signature of Employee _____ Signature of Foreman or Supervisor _____

If an employee who has received a written warning takes exception to it, he shall have five ddys from the date of warning in which to initiate action under the grievance procedure. If no such action is taken within five days, it will be assumed that the employee has acknowledged that the warning was justified.

Original—to Personnel Manager; First Copy—Retained by Foreman or Supervisor; Second Copy—to Employee

If the foreman or supervisor feels that oral warnings have been, are, or would be ineffective, he prepares a written warning. Original is sent to the personnel manager; one copy is given to the employee; a second copy is retained by the foreman. If an employee takes exception to the written warning, he has five days in which to initiate action under the company's regular grievance procedure. An employee who has received two written warnings for the same offense may be discharged upon receipt of a third written warning for the same offense. One who has received four written warnings for various offenses may be discharged upon receipt of a fifth written warning for any type of offense

4. The *attitude* or the *intent* of an offender is often of great importance in determining the seriousness of a case. This, too, must be judged and evaluated on the scene.

Not even the most "legalistic" and elaborate methods of classification seemed to provide any way to eliminate such judgmental factors as those listed above.

As a result of inability to *eliminate* the factor of judgment in discipline cases, the next conclusion was that definite limits should be placed upon the extent to which the supervisor could use discretion in the case of discharges. This was done in the following three ways:

1. By listing as specifically as practicable what should be regarded as grounds for *immediate* discharge. Meetings with all persons authorized to discharge were then used to make certain that uniform interpretation was placed upon such items as "willful insubordination" and the like.

2. By specifying other offenses that definitely *could not* be handled as cases of immediate discharge. This was done indirectly by providing distinct methods of handling for cases in this category.

3. By indicating to supervisors that discharges: (a) Are subject to review through "exit interviews"; (b) are not discharges from the company's service, but only from the service of the supervisor's department; (c) are subject to the approval of supervisors within the direct line of authority.

The final conclusion was that, in all offenses other than those requiring immediate discharge, only a *sample* list should be given indicating the *type* of case that was meant. In this instance, dependence for the sensible use of discretion was placed on the requirement that the person handling the discipline had to discuss the alleged offense with the offender. This, it was felt, would also insure that the desired constructive and corrective influence would result.

Another control over discretion in these cases, of course, was the availability of the grievance procedure. In addition, the fact that copies of all written reprimands were examined by the personnel manager before being put in the employees' folders was counted on for identification of cases of obviously poor judgment. Such cases are always followed up at once and further discussion with the supervisor is used as a means of indicating the proper course of action.

Upon analysis, it is evident that, although discretion cannot and should not be ruled out of a discipline procedure, it can be limited and directed or controlled in such a way that the supervisor can do an effective job without any loss in prestige.

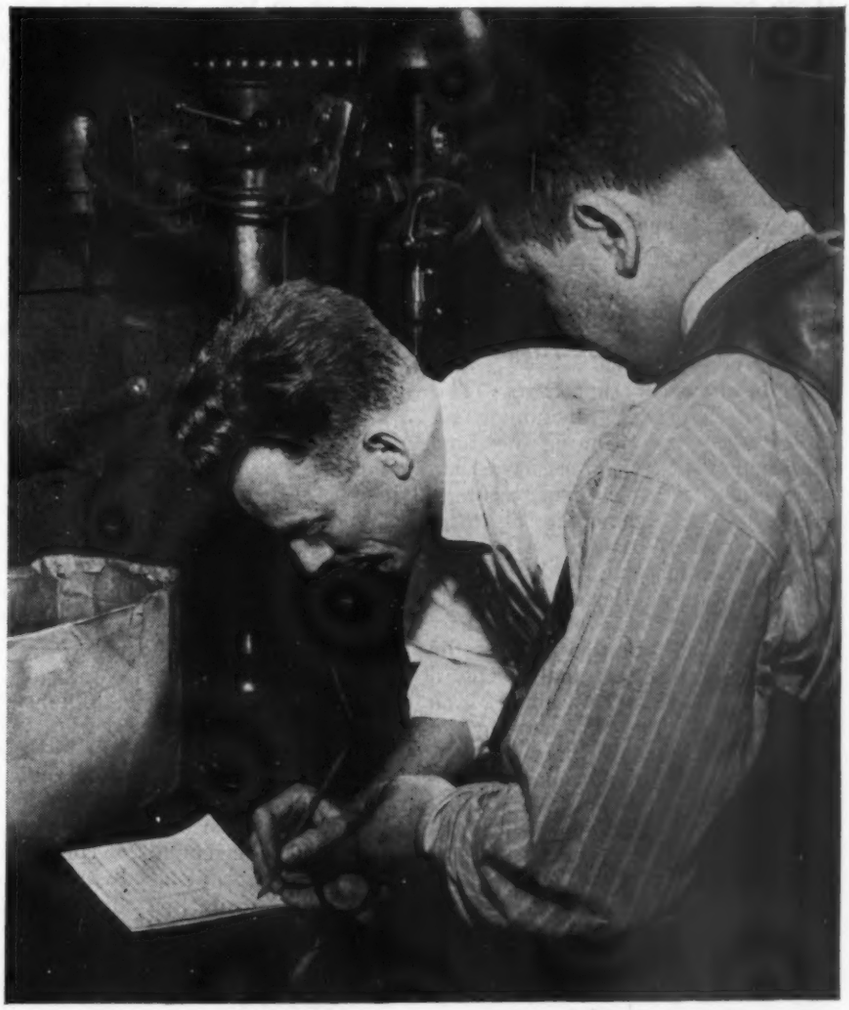
Responsibility for Disciplinary Action

The question of who shall have the authority to discipline employees for infractions of regulations has become an increasingly important and vexing one during these wartime years of heavy expansion and overworked, thinly spread supervision. In some firms there has appeared an unfortunate tendency to deny this authority to foremen or other supervisors of equivalent rank. Inasmuch as this greatly weakens the position of the supervisors involved, both in their own eyes and in the eyes of the employees working under them, such a practice is most undesirable. This is one of the many ways in which management may belittle and antagonize its supervisory staff to the point where it is not at all surprising to find that the supervisors are seriously thinking of unionization.

In the August, 1944 issue of *Supervision*, Lloyd K. Garrison, public member of the National War Labor Board, summarized the basic problem as follows:

"Who shall administer discipline? Shall it be the foremen? Dr. Taylor, WLB chairman, very strongly urges yes. That is my own feeling. In some plants it has been taken out of the hands of the foremen and turned over to so-called experts. That is one of the reasons why the morale of the foremen in some of our largest plants has apparently declined."

It has already been pointed out that the foreman plays a vital role in helping to determine the over-all morale and good working cooperation of all employees. The foreman is held re-



Written reprimands, handed out when the foreman or supervisor feels that oral warnings have been, are, or would be ineffective or insufficient, are signed both by the supervisor and the employee

Three controls insure the use of discretion in the administering of discipline at Bendix Radio Division: (1) The supervisor must "talk it over" with the employee; (2) the employee has recourse to the grievance procedure; (3) copies of written reprimands are examined (above) by the personnel manager

sponsible for the results achieved in his area of operation. He can achieve good results only if, among other things, he is given the necessary authority.

Success of the Disciplinary Procedure

1. Reactions of supervisors. The procedure has been functioning for more than a year. During this time the reactions of supervisors have been increasingly favorable. The recent response of one high-ranking plant superintendent is typical. He commented that for years he had leaned heavily toward the layoff as the only really effective form of disciplinary treatment. He admitted that in the beginning he had been quite skeptical about the use of warnings, even though they were put in writing and signed by the employee. He ended by stating that he was still amazed to find that "mere" reprimands worked out much more smoothly and effectively than his layoffs ever had and that they also had saved his plant hundreds of man-days of production that would have been lost had the layoff technique been used.

The example just cited is by no means an isolated case. Supervisors throughout the organization frankly state that they feel management has really helped to strengthen their position within the company. The consequence of this general reaction is, of course, a condition of genuine goodwill and cooperation that is very reassuring to all concerned.

2. Reactions of employees. Before setting up the new procedure, care was taken to see that the employees were informed not only of the mechanics of the procedure but also of the basic reasons underlying its development. This was done through a meeting with the union's representatives who, in turn, transmitted the information through their organization. In addition, at the time of formal initiation of the procedure it was incorporated into a new edition of the employee's handbook so that everyone was fully informed.

From the beginning the employees have responded favorably to the procedure, as well as to the method of informing them of it. In all but a small minority of cases (approximately 7 percent) written warnings have been signed by the employee concerned with no complaint or dissent. The reaction is usually that the employee is glad that "things are right out in the open." The offenders almost invariably are ready to admit their shortcomings and are glad to talk over remedial courses of action. Out of several hundred written warnings given to date, there have arisen only five grievances, and not one of them has progressed beyond the third stage of a four-step grievance procedure.

* * *

The discipline procedure as outlined and as used still permits in most cases a wide range of discretion on the part of supervision, while at the same time it requires supervision to handle its own problems without the aid of special staff activities or other "crutches." What has been accomplished has certainly not been the result of any radical changes in the factory supervisor's place in the company's general mode of operation.

What, then *has* been responsible for the success of this basically simple plan? In the judgment of the writers the answer to this question is quite clear. Except in cases of immediate discharge, for a limited number of reasons (subject to review, however), the supervisor can take no disciplinary action without discussing it with the employee concerned. The plan thus fosters the growth of a "let's talk it over" attitude. However, it does so not by much shouting and propaganda but simply by making "talking it over" an *essential part* of what has now become a *routine* plant procedure. The plan is successful because it tends to make good industrial relations practice an everyday prerequisite to further action by supervision.

Card System for Closer Control of Inventories

ROY W. STEVENS, Supervisor, Inventory Control, Cook Electric Company, Chicago

ANTICIPATION OF NEW PRODUCTS, early in 1943, together with accelerated production schedules and rapid expansion, brought forcibly home to Cook Electric Company, Chicago, the need for better control of some 1000 items of raw materials and 5000 piece-parts. The control system being used was inadequate for the numerous types of information and statistics that were required for the company's own use and for government reports.

An analysis of the tabulation system that was in use indicated that its good points were not sufficient to justify its continuance. The tabulation showed only the following: (1) Piece-part or raw material number; (2) total amount required; (3) total amount on open order; (4) total amount in stock; (5) total amount available; (6) total usage for previous three months.

This tabulation was issued in duplicate every week to ten days. It quickly became inaccurate because of the normal manufacturing activities that affect requirements, orders authorized, receipts, disbursements, and stock balances. All amounts were in total, therefore it was impossible to prove any figure without spending several hours investigating all the assembly orders in the shop that used the part in question.

No Breakdowns Available

This was particularly true in the case of common parts. There was no breakdown to show work or purchase order numbers and amounts, and no indication of work-in-process; neither was there a breakdown to show the assembly or sales orders on which the part was to be used. The compilation of the tabulation required about 48 hours of clerical and machine time per week.

Discrepancies were constantly appearing and the production planners, expediters, and order analysts had lost faith in the tabulation. They had begun to use simple visible inventory controls designed by themselves and operated independently of one another. Even these controls were not too successful, because of the use of common parts—the planners were continually robbing parts from one another, depending on which planner scheduled an assembly job first. On request, the stockroom checked bills of material so that the planners could determine which jobs to schedule; however, these checks were made without giving consideration to previous

It takes six full-time workers to keep the materials control system up to date, but the compilation of government reports is now easy, and there is no more chance for materials or parts to accumulate uselessly

requirements (which were unknown), and piece-parts were not segregated or earmarked for the job checked. Work orders for parts were issued in lot sizes determined by the known requirements and, in many instances, were uneconomical.

Actually, the tabulation system was an accounting tool. What was needed was a production tool. Therefore the tabulation system lost favor completely and a new system was mandatory. The experiences of the personnel favored a visible card control of the type that could be removed from the file for posting or analysis, and one that would give complete information on a single card.

The "Master Material Record Card" was designed to show all the necessary information; the form of the card, and the several sources of information recorded on it are shown at the right.

One Year to Install

The installation of the system, which now covers 1400 items of raw materials and 8000 piece-parts, was accomplished in approximately one year by one supervisor, one assistant, and four clerks, in the following manner:

1. A file of record cards was made from the parts listed in the tabulation, and descriptions were obtained from blueprints or bills of materials.

2. All sales requirements were posted as production reservations; deductions for shipments were made daily.

3. All outstanding work and purchase orders were posted and new orders issued (or canceled) to cover requirements, with known inventories considered. Physical inventories on active parts were made as quickly as possible.

4. All outstanding parts and materials requisitions were posted as reservations; work orders were issued to cover these requirements, or purchase orders were issued to cover raw materials requirements.

5. Receipts and issues were posted daily; stock balances were kept as soon as the physical inventories could be secured.

6. Ordering points were established for critical common parts and for all materials.

7. On December 31, 1943, a complete physical inventory was taken and posted to the cards. All cards were reviewed to determine whether or not there was adequate coverage for the requirement posted. New cards were made for items found and identified through making the inventory.

8. All postings were manual.

9. All production, stockroom, and shop personnel cooperated and contributed to the rapid installation of the system by pointing out discrepancies, which led to minor adjustments and improvements.

Everything pertaining to a sales order appears on the control card. Planners and analysts have been relieved of a time-consuming function, inactive purchased parts and raw materials are detected, and inventories have been reduced

The use of the record has simplified itself to a simple formula:

Availability = Opening inventory plus on order (or received) minus requirements.

Starting with the receipt of a sales order, the final assembly card is examined for available stock. If the item is available, it is shipped "off the shelf." If it is not, a manufacturing order is issued and the process is carried on down the line: Sales order, assembly work order, parts available or parts work order, raw material available or raw material purchase order.

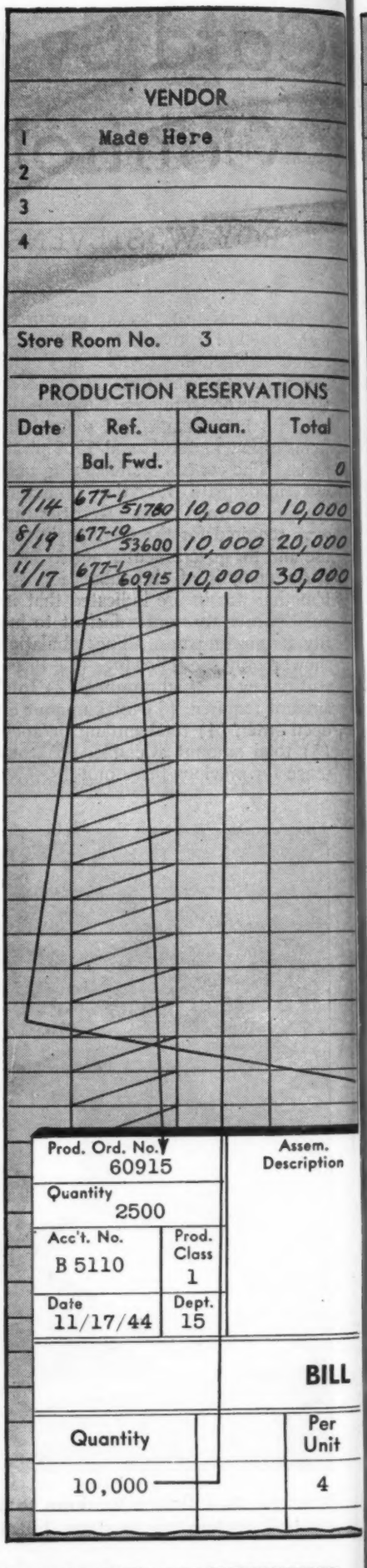
Easy to Gather Data

The compilation of government reports has become a simple routine job, compared with the former roundabout, tedious chore of gathering the information necessary to prepare a form for any of the various agencies.

Further refinements are planned, but have not been accomplished to date. They include predetermined lot sizes from sales forecasts, cyclical physical inventories (to eliminate the year-end slowdown), and production control of common parts by clerical scheduling.

Even though Cook Electric now employs six full-time employees in the materials control section, it has gained a positive control that could not be approached under the previous system. Planners and analysts have been relieved of a time-consuming function that never should have been part of their work. Inactive purchased parts and raw materials are detected, and inventories have been reduced by the substitution or sale of excessive items.

The compliments of government compliance men, who have watched the transition from the old to the new system, are indicative of the success of the visible card control system.



MASTER MATERIAL RECORD

Card No. 2 Date 7/14/44
Description Panel Bracket Per Dwg. 677-14
Part or File No. 677-1409
Spec.
Raw Mat'l 451-1607
Grade
100# Per 1000
Temper
Stocked in Dept. 31

Yearly Issues	19 43	19 44	19	Cost Per M	Est. 14.50	Last Physical Inventory	Unit of Measure
	15,000	25,000				7/14-W.S.-0	Pcs.

ORDERED				SCHED.		RECEIVED				WITHDRAWALS				BALANCE	
Date	Order	Amt.	Total	Date		Date	Ref.	Amt.	Total	Date	Ref	Amt.	Total	Date	Quan.
			0						0				0	7/14	0
7/14	51788	10,000	10,000	8/2		7/31	51788	10,000	10,000					7/31	10,000
8/19	53610	10,000	20,000	9/9						8/1	51,780	10,000	10,000	8/1	0
11/18	60922	10,000	30,000	12/2		9/11	53610	10,000	20,000	9/11	53,600	10,000	20,000	9/11	0
						12/4	60922	5,000	25,000					12/4	5,000
						12/6	60922	5,000	30,000					12/6	10,000

Clock No. | Quan. Ordered: 10,000 | Date: 11-18-44 | Part Name: Panel Bracket | Part No.: 677-1409

Prod. Ord. No.: 60922 | Quan. Finished | Acc't. No.: 4111 | Material Description: #16 U.S. Ga. x 6 5/16" Wd. x 96" Hot Rolled Steel Strip

Dept.: 11 | Prod. Class: 1 | Part No.: 677-1409 | Mat'l No.: 451-1607 | Per 1000: 100# | Drawing No.: 677-14

Quan.: 1000 | Unit: # | Mat'l No.: 451-1607 | P. P. | R. M.: X | Schedule Start. | Schedule Finish.: 12/2 | Date Finish

MASTER JOB CARD and ROUTE SHEET

Oper. No.	Dept. No.	Operation Description	Allowed Hours: Set Up	Allowed Hours: Cycle	Next Dept.	Tool or Machine No.	Deliveries: Date	Deliveries: Ticket No.	Deliveries: Am't	Deliveries: Total
1	11	Blank & Perforate	.5		30		12/4	1142	5000	5000
							12/6	1647	5000	10,000

Part No.

Panel Assembly — 677-1

OF MATERIAL

Part Number	Sec.	Bin	Description	Avail. 11-17	
677-1409			Panel Bracket	10,000	60922

Ordering Point
Next Card No. Made by

Worker Survey Shows Way to Improved Conditions

TOM N. BOGGS and LOUIS L. MANESS, Personnel Department, LeTourneau Company of Georgia, Toccoa, Ga.

SOME INDUSTRIAL LEADERS today still think "what you don't know, won't hurt you." LeTourneau Company of Georgia, Toccoa, however, believes strongly it is the little things it does not know that are hurting it, and will continue to hurt it if the "hear no evil . . see no evil . . speak no evil" attitude is adopted.

What do the men and women employees of the LeTourneau Company of Georgia really think about their company? Do they believe the company is giving them a square deal as to wages, working conditions, and promotional opportunities? Are supervisors respected, and are they impartial in their treatment of employees?

With a sincere desire to get the answers to such questions as these, LeTourneau management sticks its neck out twice a year, and invites all employees to step up and take a whack. Suggestions and complaints come flying from all departments of the plant and office, along with enough bouquets to ease the pain.

What the Polls Tell

Results of these polls indicate that the majority of the employees are happy in their work and feel that their company is doing all possible to provide good working conditions, wages, and good promotional opportunities. Percentages from last poll show:

70 percent like their present jobs.

80 percent feel that they are receiving a square deal from the company.

73 percent think their working conditions are satisfactory.

63 percent say of their opportunities are better than on their last jobs.

90 percent think their fellow-workers practice safety.

93 percent feel that the LeTourneau Company treats them as individuals, with dignity and respect.

91 percent plan to remain with the LeTourneau Company after the war.

90 percent feel that this company offers them a good and dependable future.

These percentages show a favorable picture of employee morale. They also indicate, however, that there is still room for improvement.

"Information Please," as the survey is named, is a definite bid for employee opinions and criticisms. As such, it is neither new nor original with LeTourneau. Other companies have conducted such polls, and most methods used in securing information are, in all probability, very similar. Many such plans miss the boat entirely by getting employee opinions only to pigeonhole the resulting information in a nicely bound analysis for the files in the front office.

LeTourneau has discovered, through the trial-and-error method, that the job is only half finished at this stage. What good is such information without action? Does it help management merely to know what conditions exist in its plant? What, then, is the next logical step to take?

A unique program of follow-up has been organized and proved here. Its use has shown the way to many otherwise hidden problems and grievances, and has been a revelation in ways of improvements and suggestions. It is simple, and works like this:

Following the studied preparation of the "Information Please" questionnaire, which is in part pictured on

Workers with grievances, even if they are not justified, are talked to by members of the personnel department. Every effort is made to correct the condition, or make the employee see that he is mistaken

24. Please check one in each of the following groups which you think best describes your foreman:
(Fair at all times ..... ___
(Fair most of the time ..... ___
(Seldom fair ..... ___
(Never fair ..... ___

(Here's a chance to rate the boss!) (Knows his stuff ..... ___
(Gets by ..... ___
(Workers know more than he does .... ___

(Sets a good example ..... ___
(Is a poor example ..... ___

25. Does your foreman spend any time with you training you to do a better job? Yes.... ___ No..... ___

26. Do you feel that in this company you are treated as a "human being," with dignity and respect? Yes.... ___ No..... ___

27. Do you receive personal benefit from the shop meetings? Yes.... ___ No..... ___

Suggestions: _____

28. Do you know the plant chaplain?..... Yes.... ___ No..... ___

Have you had an occasion to discuss a problem with him?..... Yes.... ___ No..... ___

Has this service been helpful to you?..... Yes.... ___ No..... ___

29. Do you know how you stand with your foreman? ..... Yes.... ___ No..... ___

30. Do you think top management backs your foreman? ..... Yes.... ___ No..... ___

Do you think your foreman backs top management? ..... Yes.... ___ No..... ___

Suggestions: _____

31. Do you take all your grievances to your foreman? ..... Yes.... ___ No..... ___

If not, why .....

32. Have your grievances been taken care of to your satisfaction? . Yes.... ___ No..... ___

Part of one page of the 7-page questionnaire that is sent to workers at LeTourneau of Georgia twice a year, so that they may express their opinions and make suggestions for improvements

these pages, a follow-up committee is elected, including representative supervisors from each shift. Members are chosen for this operating committee by popular vote of the general foremen. Certain top management officials also are represented and meet with this group twice each week for 1½-hour sessions.

After the proper announcement as to its purpose, the questionnaire, with a stamped return envelope, is mailed to each employee's home address. It is accompanied by an explanatory letter signed by the general manager. Sealed boxes are provided conveniently at the plant for those who wish to return the questionnaire personally.

Confidential treatment of returns is stressed to encourage a large percentage of participation. It is pointed out in the questionnaire that each employee may or may not sign his name, remaining anonymous unless he prefers otherwise. All results and material are kept under lock and key except when the committee itself is in session and working.

Questionnaires received during the announced period are opened on the final date. A serial number is assigned to each for analytical purposes. Then begins the work of grouping, analyzing, and studying the various types of answers and suggestions. An individual work book is prepared for each member of the Information Please Committee.

The committee has one funda-

mental purpose—to study the cause of each complaint and the merit of each suggestion. Serious consideration is given to, and definite action is taken on, every contribution. The effectiveness of the whole effort is determined from the remedial action taken.

No punches are pulled, and work begins with sleeves rolled up. Top management and supervisors have no rank, other than that of being common members of this committee, with one purpose in mind—to make LeTourneau a better place to work. There is no "tongue in the cheek" attitude on the part of company officials. Neither does the supervisor feel that he is on the spot for the stand he takes in this committee work.

It is gratifying to read the frank replies from employees. Immediate attitudes and opinions as to safety hazards, grievances, misunderstandings, jealousies, and lack of knowledge of company policy can be seen. These matters call for quick action and correction. Surprisingly many employees show their confidence in management by speaking their minds and signing their names to the questionnaires. This expression of confidence lends courage to the committee members and inspires them to display their best ability on the job for which they have been selected.

Typical Suggestions

1. "We need fans for better ventilation—too much smoke inside."

2. "Move the dump heap where trash is burned further from the plant."

3. "Water cooler near machine shop washroom should be exchanged for one that would give better service."

4. "Why can't the night shift get an operator for the plant public address system?"

Such suggestions are representative of the wholehearted cooperation received from employees. So far, so good. Now what happens? With the general manager serving as chairman the job of discussion and decision begins. Here is a problem. What can be done to correct it? Are there enough facts to take action? One committee member believes he knows what is causing the trouble. He states his beliefs and makes suggestions. Another member across the table tells what he has done in his department to prevent such trouble. At the end of the table, another member disagrees, but has a different thought to present. After all discussion is in, the proper remedy is found and proposed and a vote is taken. The majority always rules and the final answer is reached as a composite result of all the suggestions and discussion.

Here are the results of the committee's action on the suggestions:

Eighteen fans, sufficient to change the air every three minutes, were installed in the plant. The dump heap was moved to a new location. Additional water fountains were purchased and installed, and another well was drilled to maintain an adequate supply of water. An operator was employed to give switchboard service on the night shift.

Get More Information

In many instances it is found that additional information is needed before going further in considering some contributions. A personnel representative or some other logical person is then appointed to get in touch with the employee. This procedure not only affords additional facts, but also the employee sees that his thoughts are being given the attention that he had hoped for, which is no hindrance to his daily production and morale. A report is made back to the committee, and action is taken.

Reports of committee action and improvements are prepared and mailed to all employees regularly, for their knowledge of the progress being made by the committee. Individual acknowledgment is also given to each employee who submitted a signed contribution. The secretary mails a letter of appreciation, expressing the hope that its action takes care of his particular problem. Further comment is invited if thought necessary.

Here is an illustration:

One employee complained, "I can't understand why some workers in my department, doing the same work, make more money."

It was decided, by vote of the committee, that the personnel department should follow up with this employee to get more facts. It was learned during the interview, and after investigation of personnel records of this particular employee, that, although it was true he was making less money than others in his department, workers making more money were performing higher skilled work. In this particular instance, the man was a second-class operator on his job, whereas others he mentioned were rated higher.

The theory of job classification and evaluation was again explained and clarified to refresh his memory. The interview did not stop here, however. The personnel representative went further to point out to the employee just what was required before he could be promoted to the next higher classification of work. It was learned that this employee lacked one of the qualifications needed for advancement. The training department was able to supply the necessary educational assistance. Today, this employee has been promoted to a higher class of work and he is a satisfied worker, earning the money he feels he deserves.

Music in the cafeteria, more adding machines in the office, lunches during work hours, annual company barbecues, transportation, better slag hammers, are among the other suggestions reviewed. Such suggestions covered both personal and physical things. Problems were brought out that all could see and recognize. Many of the questionnaires contained plain-spoken expressions of envy, jealousy, and, at times, poor opinions of supervisors. Workers complained of partiality, unequal distribution of overtime, unfriendly attitude of some foremen, and indifference of management.

All Complaints Checked

All such complaints were read, weighed, and the merits of their suggestions considered. It was agreed that some were unjustified and represented merely the letting off of steam or personal animosity. But it was recognized also that such feelings and opinions existing in the minds of men and women were fraught with dangerous possibilities. They represented some of the hidden grievances that a man might carry within himself for years and never bring into the open. Such festering sore spots not only undermine the morale of the employee concerned, but also may spread to others in his department.

Here was a problem for supervision. To present this problem, a series of conferences was organized. All the supervisory personnel attended the meetings. The complaints that had been turned in to "Information Please" were grouped and arranged as conference material. Each complaint was analyzed and discussed in the light of causes, effects, remedies, and recommendations for improvement.

Out of these discussions came recommendations by the supervisors themselves for eliminating the adverse conditions and improving supervisory technique. Thus, by the use of the conference method, great strides were made in building up the respect and ability of supervisors. By accepting the workers' complaints as their own problem, and by their thorough discussion, supervision educated itself for the better handling of workers.

Eight-Way Pallets—an Aid to Better Handling

THE EIGHT-WAY PALLET, so-called because it can be entered by the forks of a truck not only from each of the four sides but also from the four corners, affords four basic handling advantages effective in all phases of palletized operations.

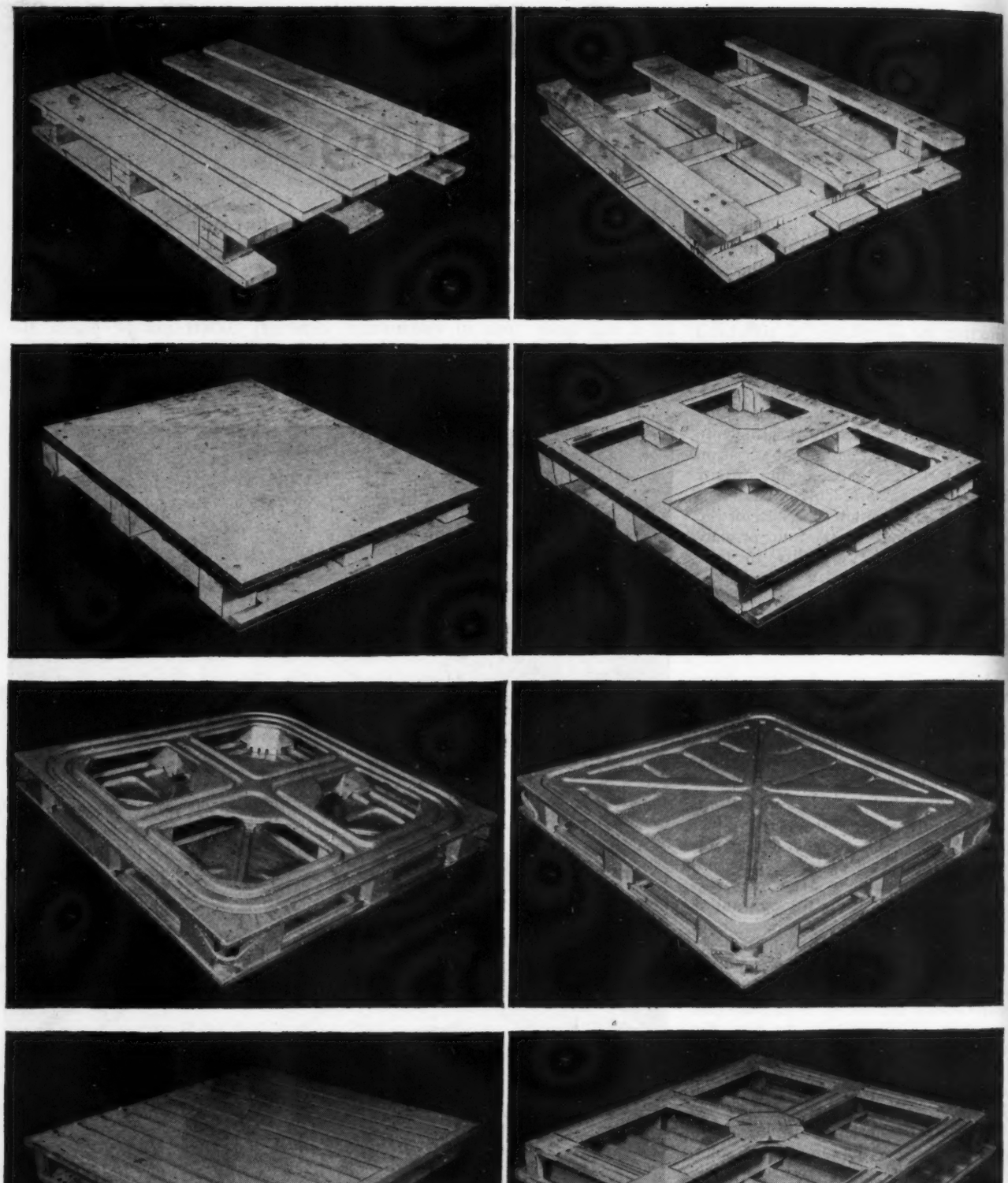
Accessible from any side or corner, this piece of handling equipment, tested in the Naval Ordnance Materials Handling Laboratory, Hingham, Mass., is a highly significant variation on the fork-truck-pallet theme. Many of the universal problems of materials handling are eliminated because of the wide application of its four primary advantages: (1) Versatility in handling; (2) flexibility of stowage arrangements (with rectangular pallets); (3) reduction of aisle space required; (4) strengthening of unit loads.

1. *An eight-way pallet set down from one direction may be picked up from another, so that removal of unit loads need not be a reversal of the placement process.* For general handling this means easy maneuverability in confined spaces such as are commonly found at the end of the production lines, in crowded aisles, or on narrow loading platforms. The feature is especially valuable in warehouses with a rapid turnover, where the position of the aisles fluctuates and where stows are apt to be buried unless they are accessible from more than one side. It is also useful in lighter loading and shiploading because it eliminates the question of which way to face the stringers in each section of the hold.

Carloading is facilitated by the eight-way feature. Flat cars and open highway trailers can be loaded or unloaded from any direction by equipment on either ground level or platform level, an advantage which becomes important if the cars or trailers are used in a congested area. When box cars are being loaded with such items as ammunition in tanks, which often require that all the units face the same way, it is handy to be able to set pallets fore and aft into the door area without need for dunnage on the deck. Also, when a fork truck on ground level is feeding loads to a hand lift truck in the car, the hand truck can run them directly into position without having to turn around.

2. *Eight-way entry enables rectangular pallets to be used in a variety of stowage patterns that would be impossible if all the pallets had to be facing the same way.* This feature can be a real space saver in warehouses having structural disadvantages such as columns, alcoves, and the like. For example, if columns are 15 feet apart, center to center, it is impractical to stow more than three standard Navy 35x45½-in. pallets of the two-way design between them, and nearly 4 feet of space is wasted. However, three eight-way pallets can be placed the wide way and one the narrow way. In irregularly shaped warehouses with alcoves or bays, similar combinations can

Laboratory model set-up shows how a fork truck of 4000-lb. capacity can enter an eight-way pallet on a diagonal at the intersection of two 7-ft. aisles. When the corner pallet has been removed, the pallets on either side of it are readily accessible



Eight-way pallets are so called because the forks of a truck may enter them from each of the four sides and the four corners. Above are four pallets that are representative of the many types developed and tested at the Naval Ordnance Materials Handling Laboratory. From top to bottom the materials used in their construction are wood, plywood with metal edge, (riveted) steel, and (welded) steel

Eight-way pallet permits the handling of diagonally stored pallets from either direction. With ordinary two-way pallets, only one approach is possible

In positioning last pallets in freight car, eight-way entry enables truck forks to get under corner of unit and swing it into position, simplifying loading

frequently be used to accommodate a greater number of loads than could be stowed with two-way pallets. Also, it may be convenient to pick up such pallets from the narrow side and take them through spaces too small for regular pallets whose stringers run the short way. In shiploading, the variety of patterns made possible often permits unit loads to be stowed in spots that would otherwise have to be filled with loose cargo.

Important is the new range of car-loading patterns that have developed. Eight-way pallets of the 35x45½-in. size will fit into a freight car either two abreast the 45½-in. way or three abreast the 35-in. way. The latter condition requires a freight car 9 feet, 2 inches wide and a pallet load with an overlap of not more than ½ inch. As a result, car capacity may be utilized more completely than was previously possible with pallets of this size. If the unit loads have no overlap, as many as 93 will fit into a standard 40½-ft. freight car so snugly that virtually no bracing will be required. Even with 1⅜ inch of overlap on each of the 35-in. sides, 87 loads can be put into a car.

By permitting 35x45½-in. pallets to be handled from either side, the eight-way feature has made important contributions to truck loading. Two units can be set into the truck the narrow way or one the wide way and one the narrow, making possible many different loading arrangements.

3. *Less handling space is required because a fork truck need make only a half turn from an aisle to enter the corner of an eight-way pallet.* Consequently, in place of the 12- to 14-ft. aisle required for a 4000-lb. capacity fork truck handling two-way standard Navy 48x48-in. pallets, 7 feet are ample provided that there are cross aisles of the same width to expose the corners of some of the pallets. Where cross aisles are not desired, eight-way pallets can be handled from an 8-ft. aisle provided there are occasional 4-ft. gaps in the stowage to permit corner entry. After one row has been removed there will be a regular 12-ft. aisle.

The value of corner entry is greatly increased if a fork truck can come in from a wide variety of angles. Three factors govern its ability to do so: Narrow forks, slender vertical supports in the pallet, and wide clearance between the vertical supports. Under proper conditions a skillful operator can find many uses for this eight-way feature.

4. *Stronger unit loads are possible with eight-way pallets, since material can easily be bound to them by athwartships straps as well as by fore and aft straps.* Good athwartships strapping may eliminate the need for sway-bracing in freight cars, simplifying loading and unloading operations. In ships, where units are apt to receive rough handling and are always subject to considerable lateral stress as the vessel rolls, this added strength is a welcome safety factor.

Under the guidance of the Naval Ordnance Materials Handling Laboratory, a variety of experimental pallets have been built of wood or metal, or both, using rivets, bolts, welds, and even certain new types of adhesives. All are designed to be handled by fork trucks, hand pallet trucks, and cranes. The best of these pallets can be expected not only to provide new conveniences in handling, but to last a lot longer than the ordinary ones in service today.

Safety Program Aims at No Accidents at All

KARL KRIEG, Safety Engineer, The Crosley Corporation, Cincinnati

HIGH HEELS, negligence, and overconfidence are placed high on the list of menaces to be combated in preventing factory accidents at The Crosley Corporation. In this company's experience the two groups of employees having the highest rate of accidents are those who have been on the job less than six months or more than ten years.

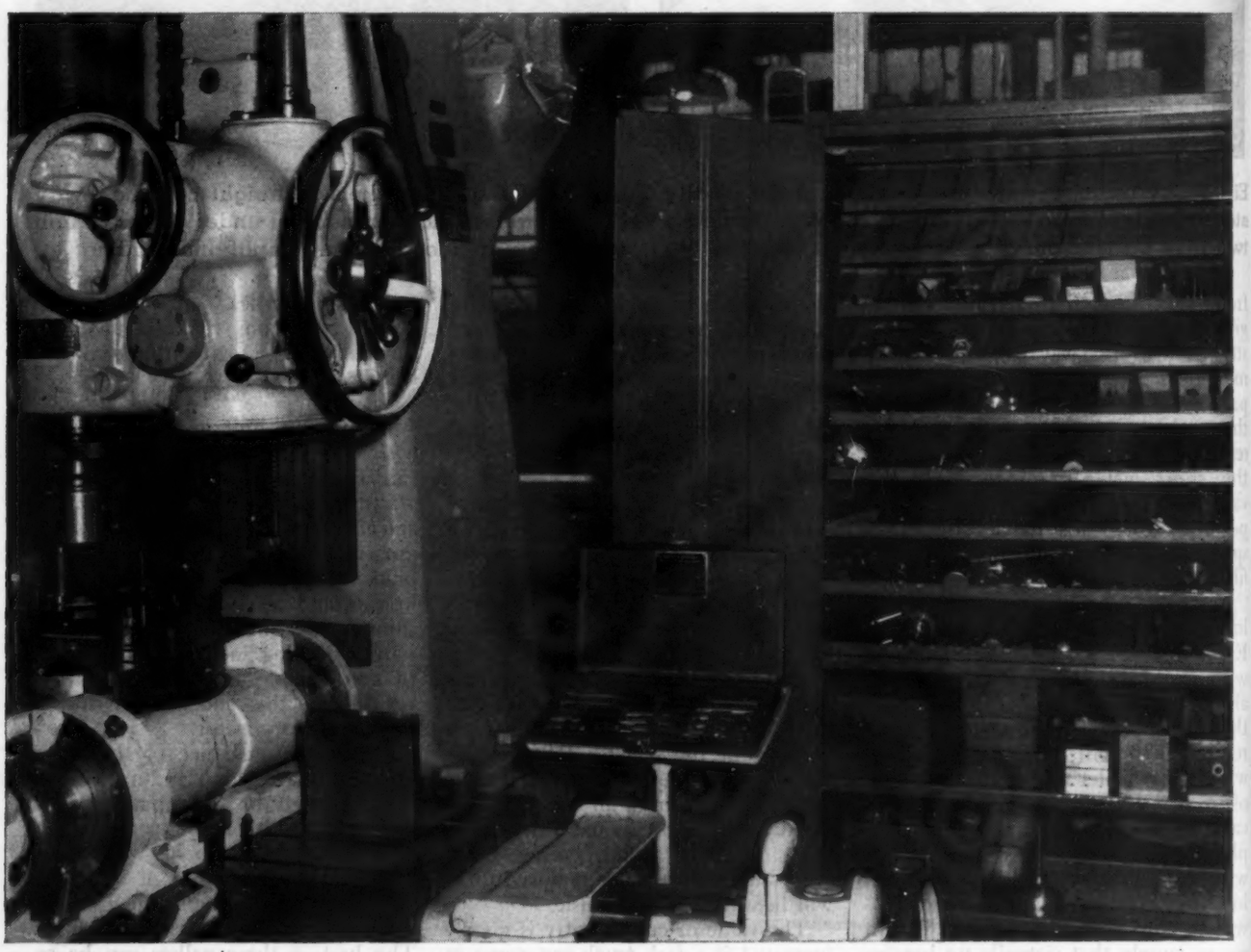
Many of the first group have not yet learned the importance of safety rules and are careless about the proper safeguards in their work and the correct clothing to prevent accidents. They are what the safety department classifies as the *high heels* group. . . . . .

The other group with a high accident rate is made up of employees of ten or more years' experience, who have become so accustomed to their work that they are *overconfident*.

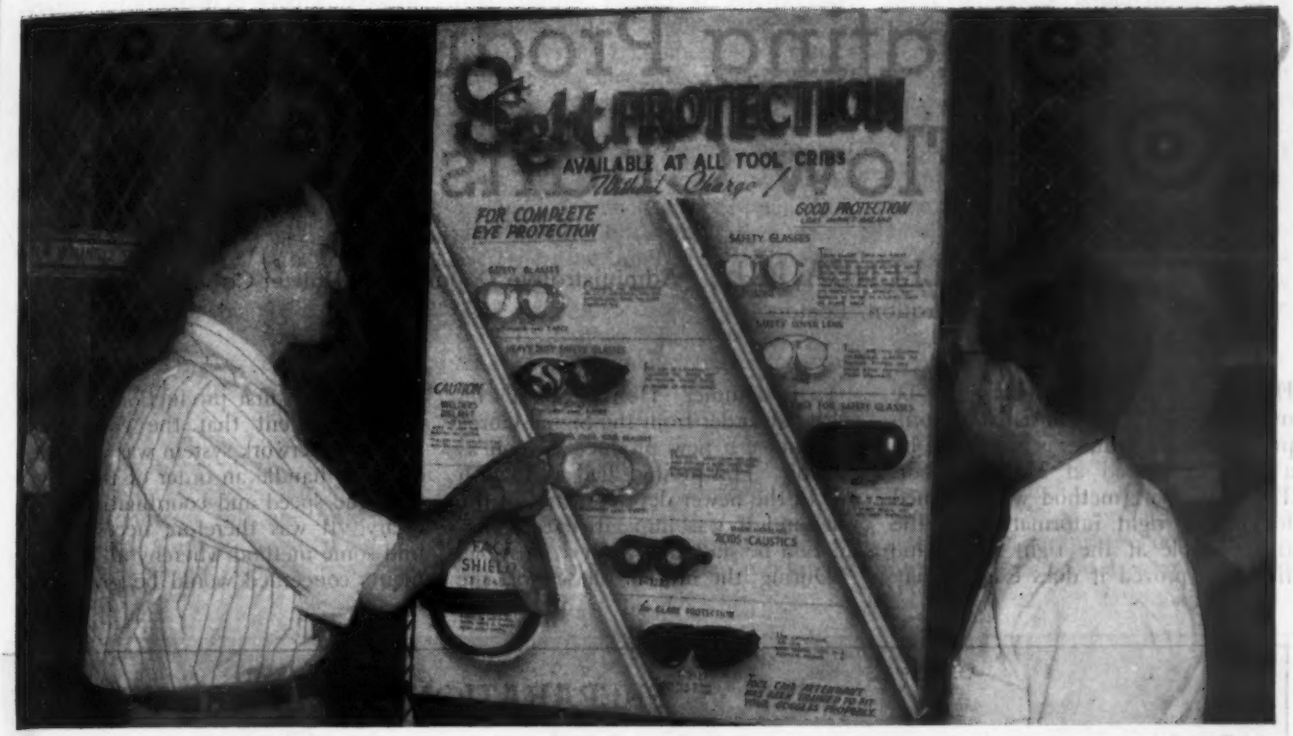
Negligence characterizes both these groups—and every accident that occurs.

That is the way Crosley sums up the reasons for accidents. Supervisors are made responsible for safety in the plant, and it is up to them to see that every person lives up to the company motto of "Good housekeeping for efficient production." If all the rules were observed, and if every person were conscious of his part in observing them, there would never be any accidents at all.

Crosley has been able to decrease



Good housekeeping is stressed by the Crosley safety department as one of the chief aids to safe operation, and is cited as one of the reasons for the company's excellent record (accident frequency reduced from 5.5 in 1943 to 3.9 in 1944). Here a jig borer, with a storage cabinet—a place for everything and everything in its place. Note machine has been painted for three dimensional seeing



Safety displays like the above are used in all four plants of the company. Crosley neglects no form of safety education and has got good results from this particular method of cautioning workers to observe safety rules and use the safeguards that have been provided for them without charge

the frequency rate (lost-time accidents per million man-hours worked) from 5.5 in 1943 to 3.9 in 1944, largely through the efforts of the management in insisting that any unsafe condition be remedied immediately, a comprehensive plan of preventive maintenance, an engineering department skilled in functional layout and facilities, a well-organized emergency set-up based on line organization, and the observance by the majority of employees of the safety rules that have been laid down for their protection.

In a survey recently made by the safety engineering department, causes of lost-time accidents for 20,762,225 hours of work in all four plants in 1944 were classified as follows:

Machinery	25
Cranes	0
Emery wheels	1
Handling materials	25
Falls of persons	18
Falling of flying objects	3
Tools (hand)	2
Electrical	0
Burns	5
Engines or cars	0
Ladders	1
Unclassified	11
	91

The difference between the Crosley frequency rate of 3.9 and the national average frequently of 7.15 is encouraging, but the company is continuing to work toward its goal of *no* lost-time accidents.

The many improvements that the company has been able to make recently for safety's sake include:

1. Having the electrical control systems made with dead-front panels and no exposed wires.

2. Raising the minimum lighting from 15 foot-candles (the equivalent of the intensity of light that would be given by 15 candles one foot away from a given area) to 35 foot-candles in all areas.

3. Obtaining better ventilation through forced circulation of air, air conditioning, and fume control at the source by the use of down-draft tables, in which fumes are immediately sucked down before escaping into the air, instead of the old method of expelling them through an overhead hood.

4. Installing automatic control of degreasing in temperature, steam flow, and time factors.

The safety organization at Plant 2 typifies the safety set-up throughout the corporation:

1. A central safety committee, consisting of the works manager and division heads, whose duty it is to approve plans and agree on policy.

2. An employee safety committee, consisting of one person from each department who has been appointed by his foreman to attend monthly meetings to view motion picture films, make suggestions, and discuss various aspects of safety.

3. Six classes a year, five sessions of two hours each, for supervisors who, upon completion of this course of instructions, are presented with certificates from the state department of vocational education.

Safety also plays a part in all training, including Job Instruction Training, Job Methods Training, Job Relations Training, vestibule training, conferences, and specialized classes in such fields as refrigeration and radio.

The staff of instructors includes eight men especially suited for their positions who spend their time exclusively in training Crosley employees in safety methods.

As a part of the safety program, each of the 250 plant guards has completed the standard Red Cross first aid course and the safety course offered by the Ohio State Department of Vocational Education, and all supervisors will take the course in 1945.

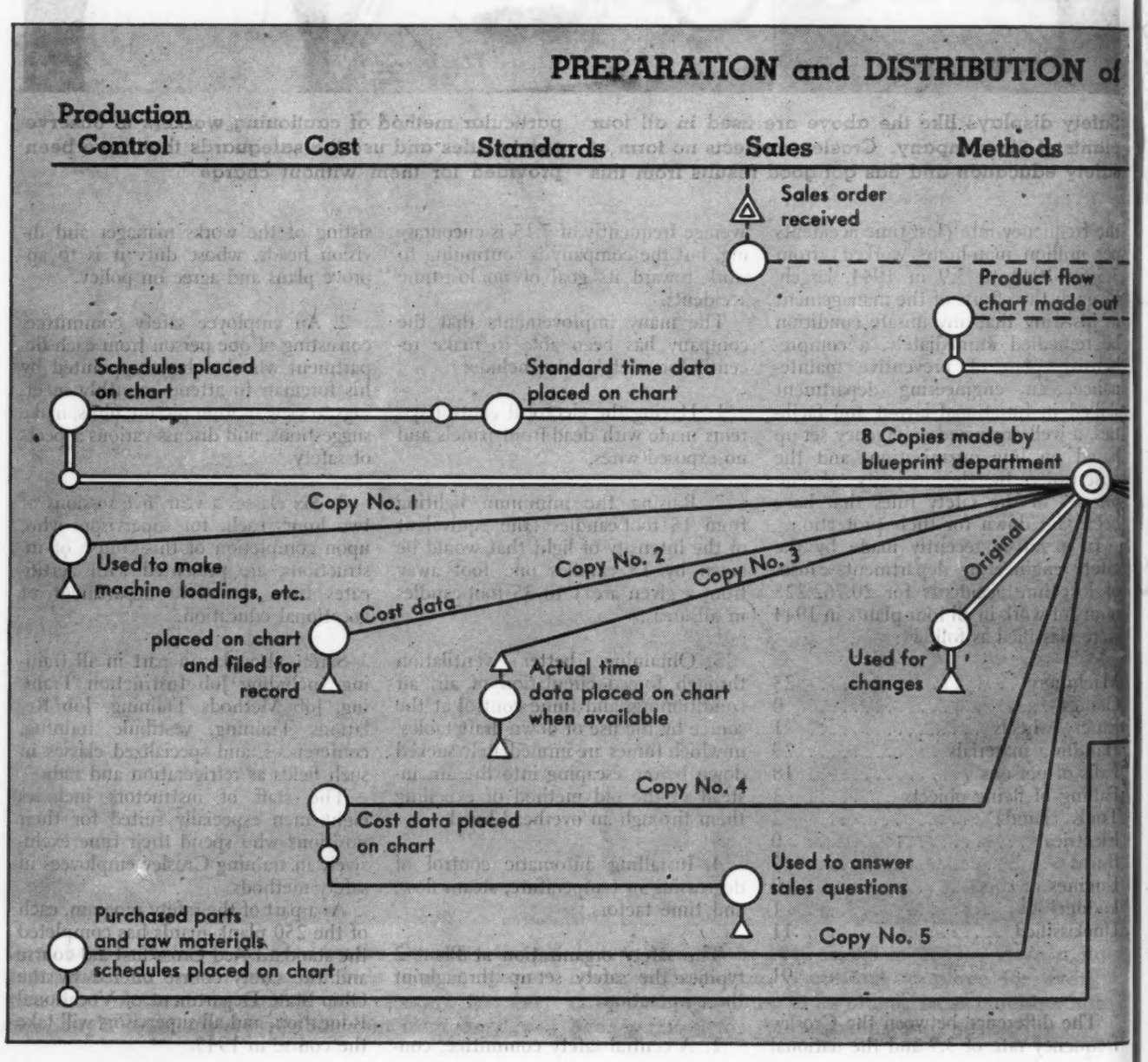
Coordinating Production With Flow Charts

WARREN G. DELLENBAUGH, Administrative Department, Holtzer-Cabot, Division of First Industrial Corporation, Boston

How PRODUCT FLOW CHARTS may be used to plan and initiate uniform production procedures is illustrated by a plan developed at Holtzer-Cabot. The flow chart method was designed to get the right information to the right people at the right time—and time has proved it does exactly that.

Last summer Holtzer-Cabot received an order from the Signal Corps to produce a new product as soon as possible. This product had to do with one of the newer developments in the war, and it was imperative that production be started as soon as possible.

During the initial phases of the planning and first production runs, it became evident that the company's regular paperwork system was not adequate to handle an order of this kind with the speed and coordination necessary. It was therefore necessary to find some method whereby all departments concerned would be given the


PREPARATION and DISTRIBUTION of
Production Control
Cost
Standards
Sales
Methods
Sales order received
Product flow chart made out
Schedules placed on chart
Standard time data placed on chart
8 Copies made by blueprint department
Copy No. 1
Used to make machine loadings, etc.
Copy No. 2
Copy No. 3
Original
Cost data placed on chart and filed for record
Actual time data placed on chart when available
Used for changes
Copy No. 4
Cost data placed on chart
Used to answer sales questions
Copy No. 5
Purchased parts and raw materials schedules placed on chart

correct information as soon as possible after the receipt of the order.

The first attempts at a plan were merely modifications of the existing bill of material and operation sheet, and it soon became evident that they were not much of an improvement and would hardly serve the purpose.

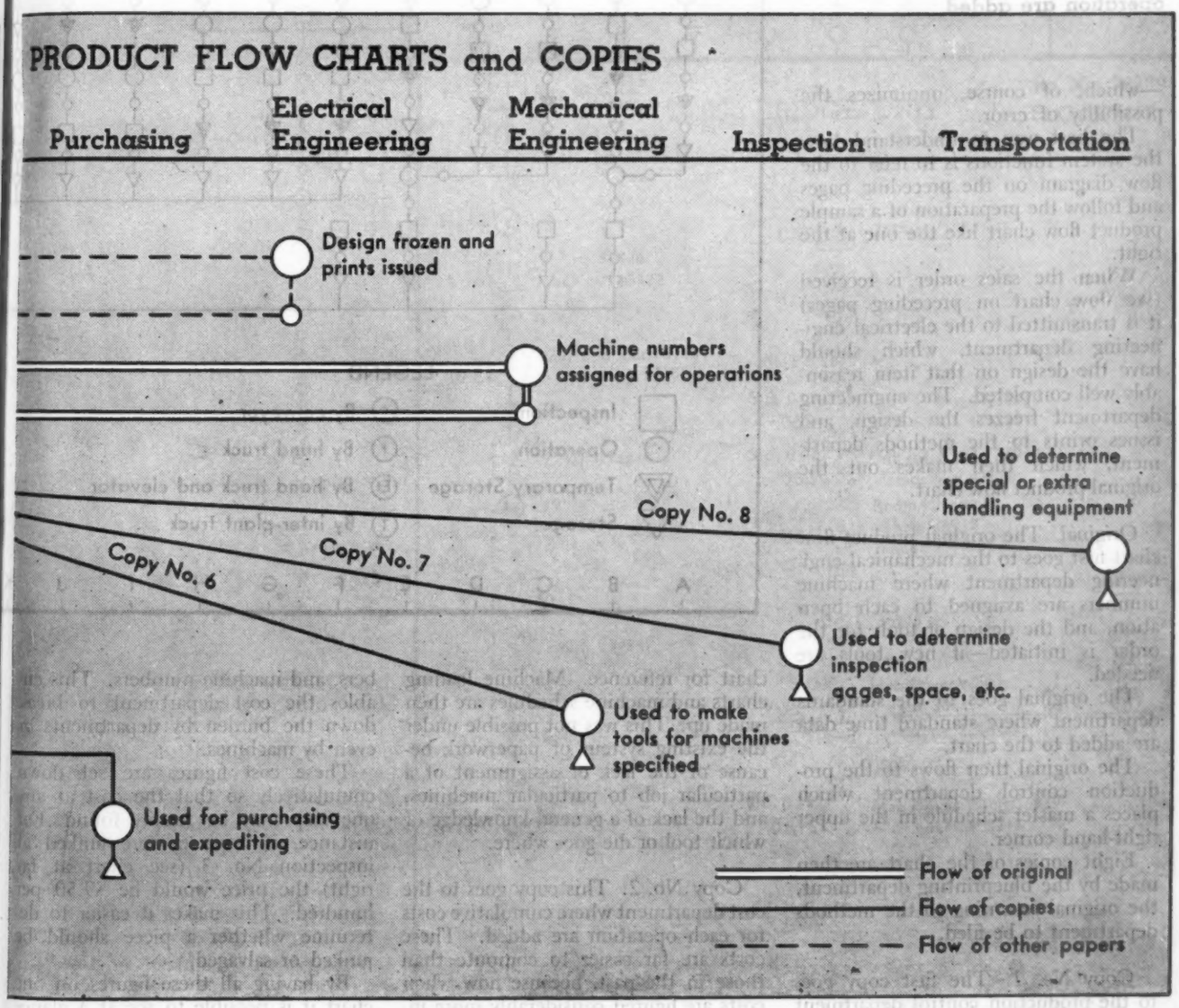
It was then that the idea was evolved of a product flow chart, which would cover an entire product rather than the processing of any one part.

This particular plan not only has been of value to the war effort, but also offers promising possibilities for the peacetime period ahead. It has been found that this method controls and initiates production, carrying it from the receipt of the sales order through pilot line stages to the start of the production run, and from then on acts as a guide to production. It coordinates all phases such as production control, inspection, engineering, methods, and standards.

This system is composed of a master product flow chart (see pages 118 and 119) on which the information pertaining to departments in the plant as a whole is placed. Standard process flow chart symbols and abbreviations are used as much as possible. This chart covers the entire product. However, there are times when the number of pieces in the completed unit is too large for a single sheet. In such cases it is necessary to break down the master chart into smaller charts for component units. From the master chart copies are made and distributed to the various departments concerned, where they collect additional, specific information that may be needed for any one department.

These charts are used by the departments to plan their layouts and meet the specific requirements for the sales order in question. In this manner all departments have the complete information necessary to establish their own routines and to get production under way at the right time. There is no reason for the "well, I didn't know" excuse. Every department works from the same information, and the possibility of misinformation is minimized. The flow of the original date, the master product flow chart, and its copies are shown in the diagram below.

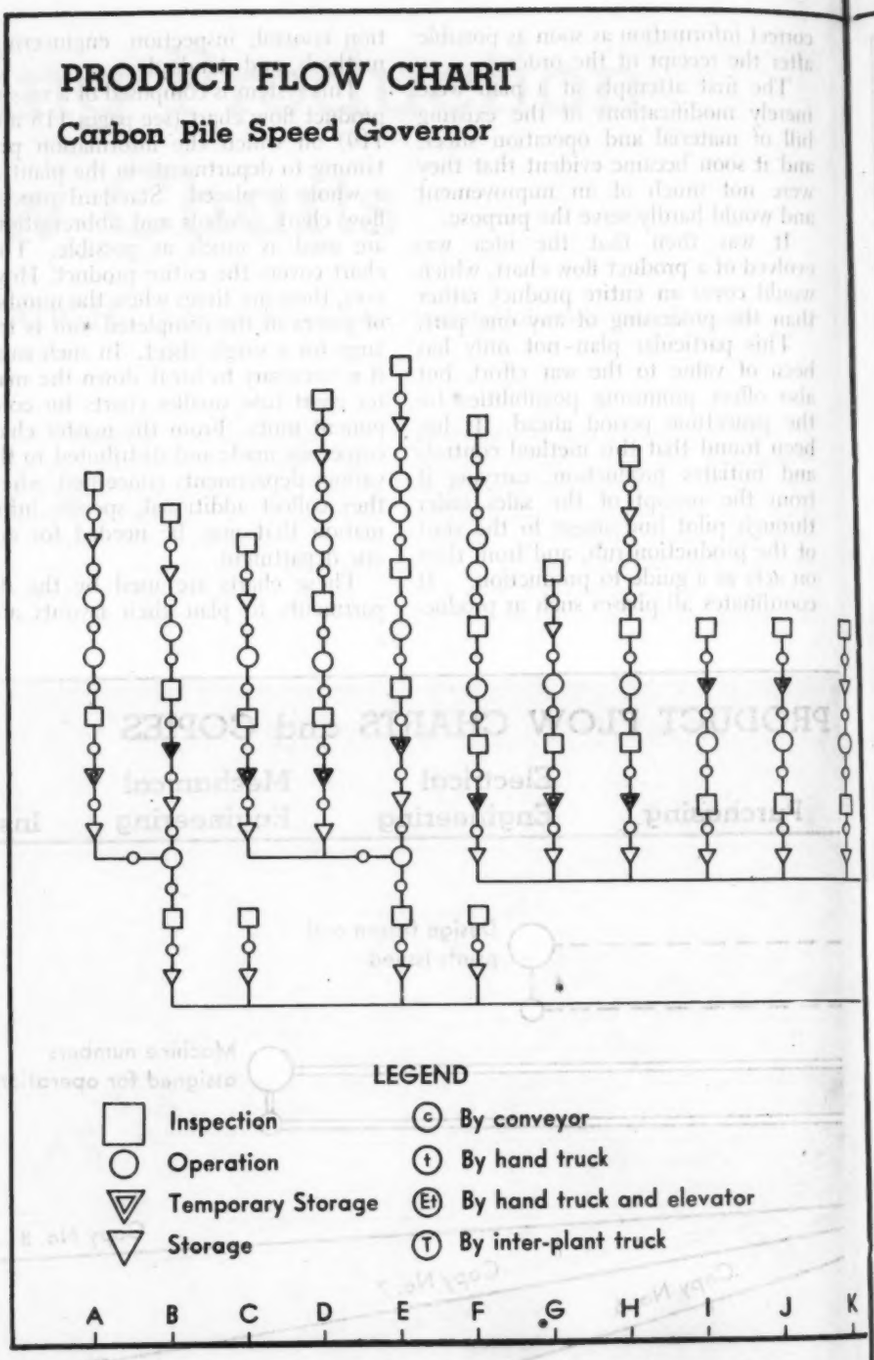
All this does not mean that additional paperwork is required. Actually the product flow chart replaces much of the paperwork already extant. There is no need for operation sheets, purchasing schedules, and other allied paperwork. As a matter of fact, the new method means a reduction in the number of times information is copied



Purpose of the product flow charts is to get the right information to the right people at the right time.

Above, chart shows flow of paperwork needed to prepare a product flow chart

Right, master product flow chart in skeleton form—i.e., with operation descriptions omitted because of need to reduce chart (actual size, 66 x 24 inches). This chart covers the entire product. Letters across the bottom correspond to those in the index shown in part on page 120. Each of the branches of the chart represents a component unit. For example, the section enclosed in the small rectangle on the facing page covers a subassembly known as a bridge unit, and this section, complete with operation descriptions, is shown in larger scale in the chart at the far right (actual size, 9 x 16 inches) which has been superimposed on the master flow chart. Note that the latter chart is copy No. 2 which goes to the cost department where cumulative costs for each operation are added



—which, of course, minimizes the possibility of error.

The best way to understand how the system functions is to refer to the flow diagram on the preceding pages and follow the preparation of a sample product flow chart like the one at the right.

When the sales order is received (see flow chart on preceding pages) it is transmitted to the electrical engineering department, which should have the design on that item reasonably well completed. The engineering department freezes the design, and issues prints to the methods department, which then makes out the original product flow chart.

Original. The original product flow chart first goes to the mechanical engineering department where machine numbers are assigned to each operation, and the design of tools for the order is initiated—if new tools are needed.

The original goes to the standards department where standard time data are added to the chart.

The original then flows to the production control department which places a master schedule in the upper right-hand corner.

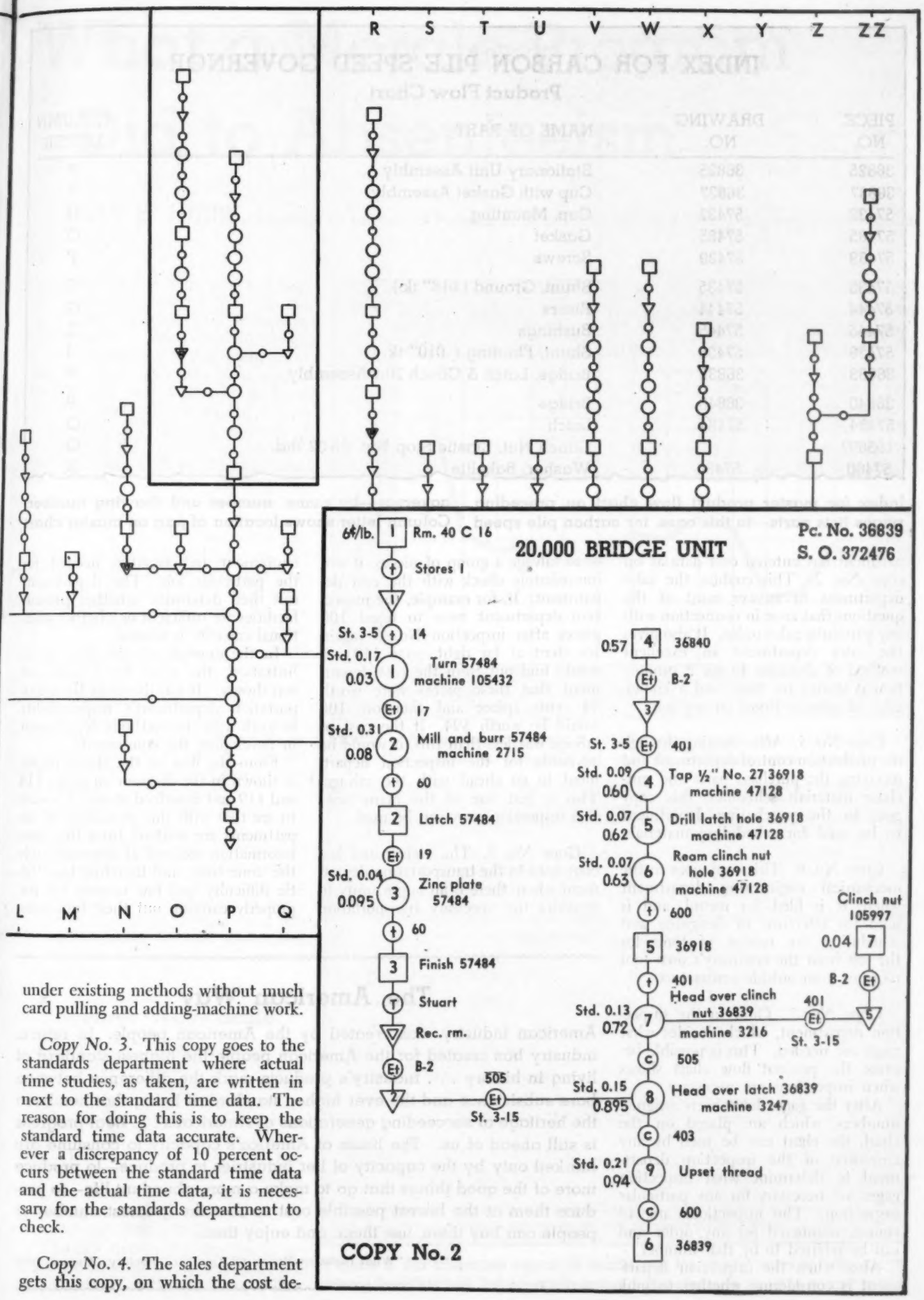
Eight copies of the chart are then made by the blueprinting department, the original returning to the methods department to be filed.

Copy No. 1. The first copy goes to the production control department where the purchase parts and purchase materials schedules are written on the chart for reference. Machine loading charts and machine schedules are then made up. This was not possible under the existing system of paperwork because of the lack of assignment of a particular job to particular machines, and the lack of a general knowledge of which tool or die goes where.

Copy No. 2. This copy goes to the cost department where cumulative costs for each operation are added. These costs are far easier to compute than those in the past, because now when costs are figured considerably more information is readily available—namely, standard time data, department numbers, and machine numbers. This enables the cost department to break down the burden by departments or even by machines.

These cost figures are set down cumulatively so that the cost at any one step may be readily found. For instance, if a piece were junked at inspection No. 3 (see chart at far right) the price would be $9.50 per hundred. This makes it easier to determine whether a piece should be junked or salvaged.

By having all these figures on one chart it is possible to see at a glance the costs for the whole product or for any one part. This was not possible



under existing methods without much card pulling and adding-machine work.

Copy No. 3. This copy goes to the standards department where actual time studies, as taken, are written in next to the standard time data. The reason for doing this is to keep the standard time data accurate. Wherever a discrepancy of 10 percent occurs between the standard time data and the actual time data, it is necessary for the standards department to check.

Copy No. 4. The sales department gets this copy, on which the cost de-

INDEX FOR CARBON PILE SPEED GOVERNOR

Product Flow Chart

PIECE NO.	DRAWING NO.	NAME OF PART	COLUMN LETTER
36825	36825	Stationary Unit Assembly	P
36837	36837	Cup with Gasket Assembly	P
57432	57432	Cup, Mounting	N
57485	57485	Gasket	O
57439	57439	Screws	F
57435	57435	Shunt, Ground (.016" tk.)	J
57444	57444	Risers	G
57445	57445	Bushings	L
57436	57436	Shunt, Floating (.010" tk.)	I
36839	36839	Bridge, Latch & Clinch Nut Assembly	P
36840	36840	Bridge	P
57484	57484	Latch	O
105997		Clinch Nut, Elastic Stop Nut #6-32 thd.	Q
57460	57460	Washer, Bakelite	K

Index for master product flow chart on preceding pages lists parts—in this case, for carbon pile speed governor—by name, number and drawing number. Column letter shows location of part on master chart

partment has entered cost data as on copy No. 2. This enables the sales department to answer most of the questions that arise in connection with any particular sales order. It also gives the sales department an excellent method of checking to see if production is started on time, and a knowledge of process times on my job.

Copy No. 5. After clearing through the production control department and receiving the purchase parts and purchase materials schedules, this copy goes to the purchasing department to be used for scheduling materials.

Copy No. 6. This copy goes to the mechanical engineering department where it is filed for record, and is used for reference in designing and scheduling the receipt of tools for the job from the company's own tool room or from outside contractors.

Copy No. 7. Goes to the inspection department, which decides what gages are needed. This is possible because the product flow chart shows when inspections are necessary.

After the gages have been assigned numbers, which are placed on the chart, the chart can be used by any employee of the inspection department to determine what inspection gages are necessary for any particular inspection. The inspections are, of course, numbered for any order and can be referred to by that number.

Also, when the inspection department is considering whether to junk or to salvage a group of pieces, it can immediately check with the cost department. If, for example, the inspection department were to reject 100 pieces after inspection No. 6 (again see chart at far right, page 119), it would find out from the cost department that these pieces were worth 94 cents apiece and therefore 100 would be worth $94. If the cost of salvage was less than this, it would be advisable for the inspection department to go ahead with the salvage. This is just one of the many ways this inspection copy can be used.

Copy No. 8. The eighth and last copy goes to the transportation department where there is an opportunity to consider the necessary transportation equipment and facilities needed for the particular job. The department can then determine whether present facilities are sufficient or whether additional capacity is needed.

In the example chosen here for illustration, the need for a conveyor was shown. It was therefore the transportation department's responsibility to work with the methods department in developing the equipment.

From the flow of the above paper, as shown in the diagram on pages 118 and 119 and described above, it is easy to see that with this procedure all departments are working from the same information received at approximately the same time, and therefore have little difficulty and few excuses for improperly carrying out their functions.

The American Way

American industry was created by the American people. In return, industry has created for the American people the highest standard of living in history . . . Industry's products mark the difference between bare subsistence and the ever higher standard of living that has been the heritage of succeeding generations of Americans . . . Real progress is still ahead of us. The limits of America's capacity to consume are marked only by the capacity of her industries to produce—to produce more of the good things that go to make a more abundant life—to produce them at the lowest possible cost so that the greatest number of people can buy them, use them, and enjoy them.

"What Industry Means to America," Factory, August, 1936

What a Morale Program Did to Absenteeism

RAY E. HIBBS, Director of Industrial Relations, North Star Woolen Mill Company, Minneapolis

ABSENTEEISM has been knocked into the proverbial "cocked hat" at the North Star Woolen Mill Company, Minneapolis. Since March, 1943, when absenteeism in the main plant reached a peak of nearly 8 percent, it has dropped to 2.2 percent in January this year. These figures are arrived at by the accepted method of multiplying the total number of working hours in a week by the total number of employees, and dividing the total number of man-hours lost to absences by the product.

In December, 1943, when the program to combat absenteeism was just getting under way, 504 man-days were lost. In December, 1944, that figure had dropped to 219. After the program had been put into operation at the company's Lima, Ohio, plant absenteeism was reduced 50 percent. The record takes on added significance when compared with the records of many other plants. Most authorities agree that the national figure of absenteeism is running at least 5.7 percent from all causes—2½ times greater than North Star's present record.

Following is an outline of the program that has done the job in a plant where conditions were certainly no more favorable than in the average factory. For instance, the average age of the men in the plant is 39 years, the women average 46 years—and this group, according to most authorities, is supposed to be particularly bad in attendance.

Average Wage Scale

Going still further, most of the women employees are married—and married women are supposed to be the worst offenders of all. Employees are not controlled through high wage incentives, since the wage scale is average. Despite all this, plus the fact that all absences are counted, whether they are excused or not, absences from *all* causes have been reduced to the low averages shown in Figure 1.

The first step in the program to reduce absenteeism was to determine the exact nature of the problem. This

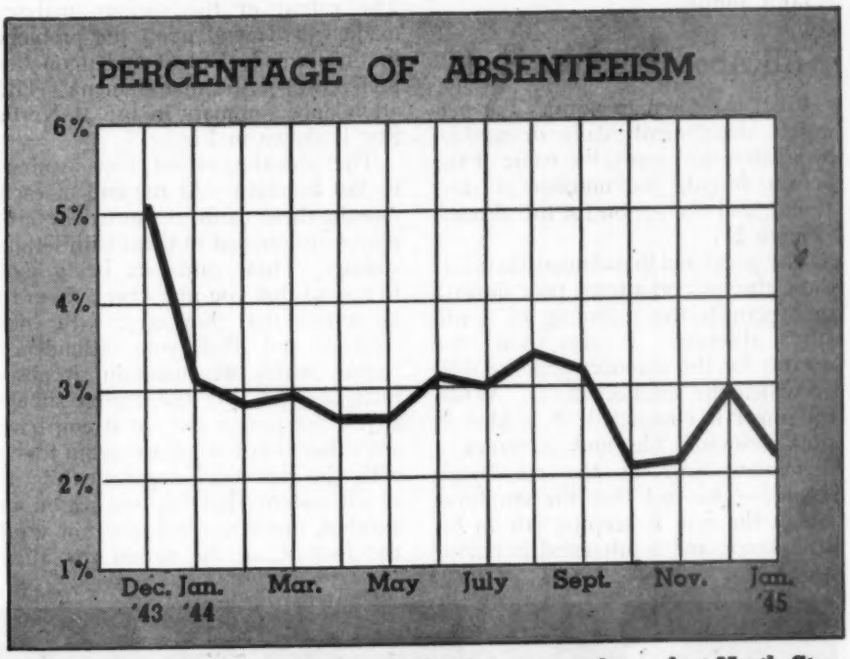


Figure 1. Absenteeism shows a decided downward trend at North Star since the intensive program of morale building was inaugurated

ABSENTEE REPORT

Name_____ Department No._____ Clock No._____

Month_____ Dates_____ Shift — 1 2 3

REASONS for ABSENCE

1. Death or illness in immediate family ☐
2. Sickness ☐
3. Take care of children ☐
4. Relatives home on leave ☐
5. Other reasons ☐
6. Severe illness or hospitalization ☐
7. Plant injury ☐

(If either 6 or 7, leaves of absence should be sent through if absence is) (to be of EIGHT OR MORE DAYS duration.)

Noted_____ Signed_____ Date____ 194

Personnel Department — Foreman

This form is due in the Personnel Department on Tuesday of each week. covering absences for the preceding work week.

Figure 2. An absentee report is made out for every worker who stays away from his job. Information gained therefrom is used in many ways

required statistics, but statistics would have meant little unless they helped solve the problem they revealed. Since partial or incorrect information breeds wrong conclusions, these statistics had to be complete, and they had to be accurate.

Briefly, the system provides for determining the following: Who is absent; when he is absent; and why he is absent. This information, when summarized by department and by the plant as a whole, is sufficient. The method of obtaining this information is fairly simple.

All Absences Recorded

First, the foreman notifies the personnel department, daily or weekly, by an absentee report, the name of the person absent, the number of days absent, and the reason for the absence (Figure 2).

The personnel department then lists these absences on a form (not shown) that permits the recording of a full year's absences. It also shows the reasons for the absences and the days on which the absences occur. When the sheet is completed, it is filed in the personnel file and becomes a permanent part of the employee's record. The fact that the employee knows the firm is keeping tab on his attendance, and is interested in having that record of attendance as perfect as possible, contributes a great deal to keeping absenteeism at a low level.

After posting the yearly record, the absentee report cards are sorted by department, and the data are accumulated for the summary of attendance and lost man-days for the week or month as desired. If additional breakdowns are desired, such as the ratio of excused to unexcused absences, or if recapitulation of the reasons is wanted, these cards permit rapid sorting for preparation of such statistics. The extent of the various analyses made will depend upon the problem in the individual plant and upon the preference of the management. The attendance summary in use at North Star is shown in Figure 3.

The absentee report now assumes its last function. At the end of each month, these cards are sorted by employee and mailed to them with letters stating, "These cards are being sent to you so that you may check them to be certain that they agree with your records, and that your attendance record, which we maintain, is absolutely correct. If the reason shown is not the proper one, or if you have any other question, please get in touch with the personnel department." It is self-evident that for one reason or another, many workers may not want the fact of, or the reason for, their absences to become known to other members of the family.

Having determined the exact nature of the problem, the next step was to devise ways and means of solving it. Generally speaking, there are two broad methods of approaching the problem of absenteeism—the negative and the positive. Undoubtedly, the negative approach has attained widespread use during the last year or two. Some plants may have reduced absenteeism by it, by "disciplining" employees, by sending them home when they did not report for work after unexcused or unexplained absences, or by holding employees up to ridicule or reproach among their fellow-workers.

Management at North Star Woolen Mill Company has deliberately steered clear of any effort to control absenteeism by negative methods. It has stuck to the positive approach. The aim is to build up attendance by selling employees on wanting to come to work, instead of remaining at home, and at the same time to build sound employer-employee relations for the future.

There is, of course, no known panacea for absenteeism. The problem is one of individual plant conditions, and proper control must vary according to the nature of the absences. After diagnosing the facts, it is possible to apply the most suitable remedial measure.

For instance, in general there are only two reasons for absences: (1) Employees *cannot* come to work; (2) employees *will not* come to work. Solution of the problem is likewise twofold: (1) Help employees avoid *involuntary* absences; (2) get employees into the frame of mind so that they will prefer to come to work, rather than to stay away.

To help employees avoid involuntary absences, every precaution was taken against the occurrence of situations that might give rise to such absences. Some of the essentials for controlling involuntary absenteeism may be listed as follows:

Illness, Injury, Health

1. Entrance and periodic physical examinations for all employees.

2. Ample, well-equipped, and easily accessible first aid stations.

3. Health suggestions through house organ, bulletins, posters.

4. Well-planned safety and accident prevention campaigns.

5. Being certain that company doctor appreciates importance of keeping

The quality of supervision is important in preventing absenteeism. Adequate instruction, encouragement, and praise for a job well done, all contribute to worker morale—and to a good attendance record

ABSENTEE SUMMARY

Month_____ Year_____

Department	Number of Employees	Working Days No.	Total Man Days No.	Total Man Days Worked No.	Total Man Days Worked %	Total Man Days Lost No.	Total Man Days Lost %
1 – Wool Sorting							
2 4 – Wool Preparation							
TOTAL							

SUMMARY of REASONS for ABSENCES

Reason No.	Description	Department 1	2-4	3	5	6-7	8	9	10	11	12	13	15	25	32	Total
1.	Death or illness in immediate family															
2.	Sickness (self)															
3.	Take care of children															
4.	Relatives home on leave															
5.	Other reasons															
6.	Severe illness or hospitalization															
7.	Plant injury															
	TOTAL															

4 copies: Director of Industrial Relations, Operations Manager, Plant Manager and Personnel Department

Figure 3. Built from absentee report totals, the absentee summary shows the way to possible improvements

a worker on the job whenever it can be done without injury to his health. Doctors can add unnecessary absences by (a) asking patient to "Come back next Tuesday and let me see how you are getting along," thus adding another day, or at least part of one, to already high absenteeism; (b) advising worker to stay home longer than is absolutely necessary, after treating illness or injury, thus hurting worker's pocketbook and company's production.

6. Properly scheduled vacations and rest periods.

7. Cafeteria facilities, where it is possible for workers on all shifts to obtain nourishing food.

8. Properly planned working hours in order to permit best possible shift arrangements.

9. Elimination, as far as possible, of excessively long work weeks.

Transportation, Housing

1. Adjusting shifts to permit maximum utilization of existing transportation facilities, or arranging for proper transportation by use of buses.

2. Forming motor pools and ride-sharing arrangements.

3. Providing assistance in obtaining gasoline.

4. Assisting employees in finding housing accommodations.

Personal Problems

1. Advising on financial matters, income taxes, and legal problems.

2. Advising and helping on Selective Service problems.

The final and most important step in combating absenteeism at North Star was to see to it that every precaution was taken against the occurrence of situations that would tend to cause an employee *not* to want to come to work.

This implied the matter of morale. Most authorities say that bad morale is one of the major causes of voluntary absences.

Some of the things found helpful in building good morale, and consequently a better attendance record, are:

1. Proper selection and placement of employees.

2. Proper induction procedures including (a) information regarding the company, the work, safety rules, shop rules, location of washrooms, lockers, first aid stations, method of recording time worked, rates of pay, pay days, internal security rules, policy regarding promotions, and names and titles of all supervisors with whom the em-

When all workers get together at a good party, good will among themselves, and toward the company, is an almost inevitable result

ployee will have contact; (b) proper follow-up to see that employee is being helped to adapt himself to his new surroundings.

3. Proper training and adequate job instruction.

Elimination of monotony and fatigue as far as possible definitely contributes toward curbing absences charged to illness. It has been found that changes in the routine, even though such changes may consist only of rest periods and an adequate lunch period, often provide enough variety to reduce monotony.

The importance of a properly handled nutrition program cannot be overestimated as a factor in boosting morale. When workers are found in the North Star plant who have had cafeteria experience, or who can be readily trained, they are used in the lunchroom. Employees seem to like the idea better to start with, and, what is more important, the lunchroom employees have a much better understanding of the likes and dislikes of the people they are serving.

Curing all grievances, real or fancied, is another "must" in the program to combat absenteeism.

Honoring workers, by publishing photographs and stories in the company newspaper when they establish outstanding attendance records, is another morale-building device that has been found extremely helpful.

Presenting "service awards" for length of service also is effective. Recognition points are broken down so that a man does not have to work 25 to 50 years before receiving recognition. North Star uses 5 years, 15 years, and 25 years as the breaking points. Solid gold pins are awarded to all groups; but the 15-year pin has a pearl, the 25-year pin has a diamond, and, in addition, the 25-year group receive gold watches. It costs a lot of money, but all of it comes back with interest in a very short time.

Importance of Supervision

Finally, as a factor in keeping morale at a high level and so reducing absenteeism, it has been found expedient to insure a high quality of supervision. Foremen are expected, for instance, to provide help necessary to achieve expected results. They are instructed to encourage suggestions from workers for improvements. And they are asked to tell workers whether their work is improving.

For example, instead of using a high-pressure, critical approach, a wise and considerate foreman handles the returning absentee in this manner: When the worker reports back after an unexcused absence, the supervisor asks him in a kindly manner why he was absent. If the man has a valid reason, the foreman merely points out that the employee should have notified him in advance so that other arrangements could have been made. If the man has no valid reason, but has had a reasonably good record, the foreman points out how much the absence cost from the standpoint of the output of the department. He may even show him the work that remains undone as a result of his absence. While not all absentees can be cured or even improved by this method, those who are curable usually fall in line with this treatment. Those who do not respond can then be disciplined as circumstances warrant.

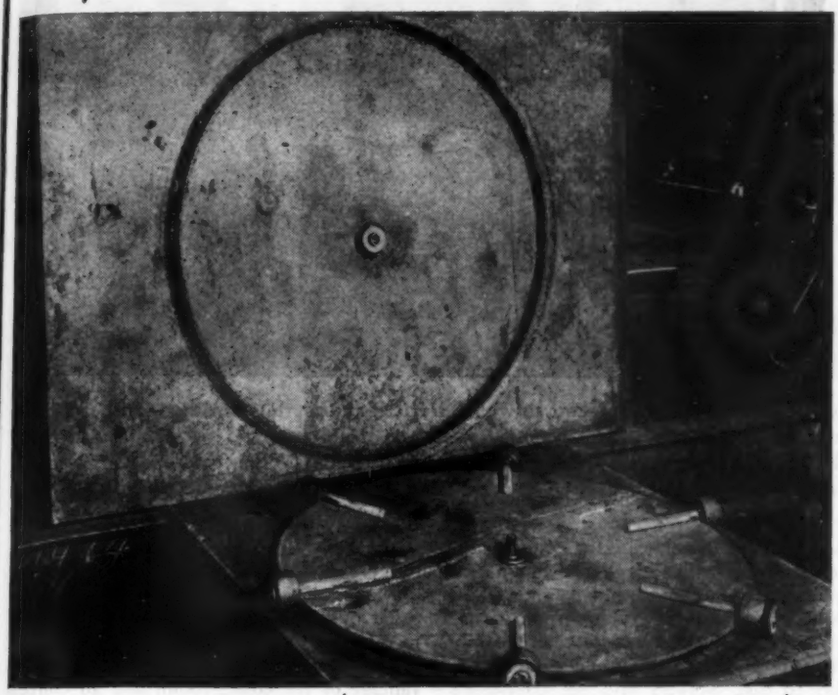
Want to Go to Work

The important fact to keep in mind is the necessity of getting employees into the frame of mind so they will prefer to come to work, rather than to stay away. Not every method will work with every employee or even at every plant. In order to reach everyone, a variety of things must be tried—perhaps one of them will work. In this connection, the foreman of one department reported that his people had come to him with a petition asking that a certain worker be fired because he was off the job so much. The foreman pointed out how hard it was to obtain new employees, but said that he would let the man go if his absences were creating an unusually heavy burden for the department.

Then one workman spoke up and admitted that the reason they wanted the man fired was because he was spoiling their attendance record; he had, in fact, kept them from being ranked first in attendance in the mill during the previous month, and they were not going to stand for it any longer. He went on to say that several of them had come to work when they were feeling none too well, just to keep the attendance record good, and they "didn't think it should be spoiled by one no-account worker who stayed home because he was lazy." Needless to add, the worker was fired. Not all employees will react to this type of incentive, at least to such an extreme, but somewhere there is a method suited to each type which will bring results.

MANAGEMENT SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for



Formerly steel plates had to be handled by crane. With the turntable, one man turns 5 tons of material with one hand, handles 20 plates in a day instead of the six or eight that formerly made up a day's work

Turntable Trebles Steel Plate Production

SIDNEY L. GILBERT, Lamson Corporation, Syracuse, N. Y.

A materials handling device that will save many hours of handling has recently been developed at Lamson Corporation, Syracuse, N. Y., in the burning off to size of large steel plates. Because of the physical restrictions of the machine, a crosswise cut of more than 4½ feet could not be taken, although the machine has a capacity of 14 feet lengthwise. Consequently, any plate more than 4½ feet wide had to be turned for each side cut.

Turning the plates called for the services of a crane, and each plate required three or four crane operations. Aside from the cost of crane operation, much time was wasted waiting for the crane to be available and to swing into position.

A simple turntable that allows the worker to position work by hand was built. A number of sheets are placed in position at one time, and 5 tons of plate can be rotated with one hand.

Before the positioner was installed, six to eight plates could be handled in a day. Now 20 plates can be turned out every day. The accompanying photograph shows the ingeniousness and simplicity of the table that accomplished this saving in time.

•

Castings Handled Fast in Pallet-Type Boxes

HARRY G. WESSEL, Foreman, Die and Mold Department, Westinghouse Air-brake Company, Wilmerding, Pa.

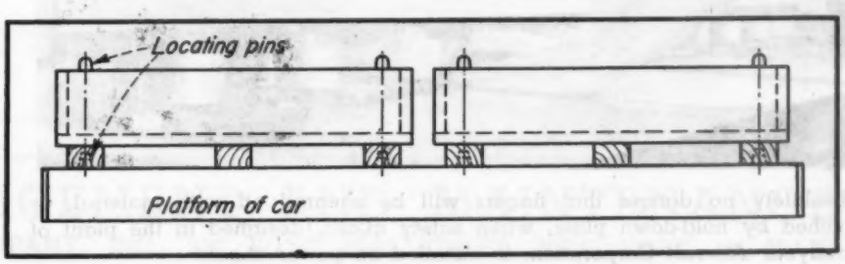
Hauling castings from foundries to the machine shops or open yard storage is done by means of a narrow-gage industrial railway. The cars are of the flat car type, with a box section or sideboards constructed to hold the castings in transit.

For years the practice has been to load these cars at the cleaning room at the foundry and haul them to sidings near the storage yards. They were then unloaded by hand onto skids or into hand trucks for distribution to the machine shop or storage in the yards. A large force of laborers was required, as well as considerable space for sidings while the cars were being unloaded.

By removing the sideboards from the flat cars and replacing them with two pallet-type boxes, as shown in the sketch, it is possible to unload the cars with a fork-type electric truck. The boxes containing the castings are either placed directly in yard storage or on skids, so that they can be moved with a standard electric truck.

Each box has four tapered holes in the rails on the underside and four tapered steel pins in a corresponding location in the upper edge. The flat cars have eight tapered steel pins to locate the boxes, and also to prevent their shifting in transit. This insures safe stacking in storage, and permits the use of a second tier of boxes on the flat cars when the weight of the castings permits.

The result is a great saving in time, labor, and trackage required. Also, fewer cars are needed, because they can be unloaded quickly and returned to the foundry in a matter of hours instead of days.



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Workers' Club Provides for Quick Transfusions

"Help to save a life" is the working idea back of the Falk Life Savers' Club recently formed by workers at The Falk Corporation, Milwaukee.

The club is the outgrowth of the tremendous response by Falk employees to the Red Cross calls for blood donations. Membership is entirely voluntary. Any employee may register and have his blood typed. The plant hospital is cooperating, and will keep the records on file.

If an emergency arises calling for a blood transfusion, persons having the same type of blood as the patient will be notified,

and a call will be made for volunteers to help save a life.

A recent case at the plant brought a tremendous response. An employee was taken ill, and blood transfusions were required. Within an hour 31 fellow-employees appeared at the hospital to offer their blood.

The Life Savers' Club hopes, through its organization, to eliminate unnecessary delays when an emergency arises. Members benefit by having their blood types on record, should they themselves ever need a transfusion.

All members in the club are entitled to wear a specially designed pin.

•

Output Increased When Company Tells Plans

P. D. KEATING, Naugatuck, Conn.

With the war in Europe over, many factory workers are beginning to think about their own futures. Will the end of war mean the end of their jobs? Many plant officials have noticed a let-down in production as the news from the battle fronts improves.

The Casco Company, Bridgeport, Conn., has found a solution to this problem. It has begun a program of morale building by bringing to the attention of the workers all plans for future production. In other words, when the company receives orders for post-war work, the news is placed on bulletin boards so that all may read it. In this way the worker can find out what the future has in store for him, and he can feel sure that the end of the war does not mean dismissal for him.

He is given to understand, also, that the company is interested in his welfare and, because it is sharing its "secrets" with him, he is made to feel that he is a member of the family. He is therefore willing to cooperate and do his part to keep the company a going organization.

Casco officials have found that this procedure has already paid dividends. When they recently announced that the manufacture of electric heating pads would soon be resumed, employees' morale showed an immediate and decided improvement. It was decided then and there that, as only satisfied workers will produce, it really pays to take workers into the company's confidence.

Not only does the pint-sized power lift truck make the loadings and unloadings of skids of paper (average weight, 3250 pounds) a one-man job at Michigan Lithographing Company, Grand Rapids, Mich., it also goes along when skid loads are shipped around the city, to assist in making the delivery

•

Coffee "On the House" Is Morale Builder

MARGARET GOODRICH, Seattle

The Cunningham Steel Foundry, Seattle, Wash., recently purchased a used coffee urn, and set it up in a small, freshly painted room across the yard from the main foundry building.

Many a headache and eardrum has been eased by a cup of steaming coffee gulped in a few minutes of respite from the roaring furnaces. All employees may take advantage of the coffee room, and all coffee is served "on the house." Those who must have sugar with their coffee either bring their own, or else bring in a ration stamp. The janitor has charge of all private stocks of sugar.

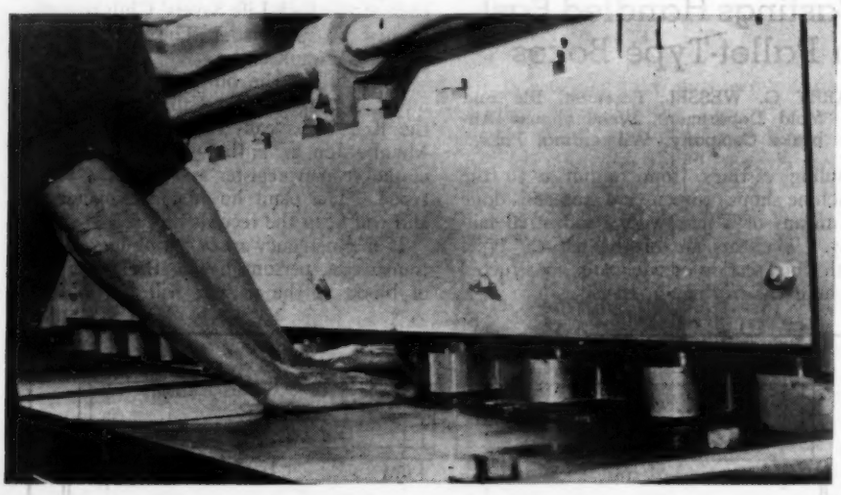
•

Power Shears Guard Assures Safe Operation

Operators of power shears at Goodyear Aircraft Corporation, Akron, can work with the feeling of complete security because of a protective guard that keeps fingers not only away from the dangerous cutting blade but also from the pinching action of the hold-down plate.

The guard is constructed of a $\frac{1}{8}$-in. steel sheet that hangs behind the hold-down plate and is attached to the base frame with flat-head screws. This arrangement allows the guard to be stationary while the hold-down plate moves. To the $\frac{1}{8}$-in. steel sheet are riveted $\frac{1}{16}$-in. steel skirts to enclose the parts of the hold-down plate coming in contact with the material being sheared. The guard and skirt assembly is adjusted to a height from the table that allows only the material to pass under, but is too narrow to permit the fingers to pass through.

As a result, the fingers of an operator can be placed within a fraction of an inch of the blade with complete security, even against unsuspected dropping of the blade.



Absolutely no danger that fingers will be sheared off with material, or pinched by hold-down plate, when safety guard, designed in the plant of Goodyear Aircraft Corporation, is installed on power shears

MAINTENANCE SERVICES

The well-maintained plant is the high-production plant

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

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MAINTENANCE as the Editors See It

There's a Big Transition Job Ahead of Maintenance

MAINTENANCE can do a great deal to keep industry on an even keel during the transition from wartime to peacetime production.

At the moment industry is, and it will be for some time, in an awkward position. A tough war still remains to be fought and won. That will require the continuing production of large quantities of war materiél. Some plants will be more or less completely occupied with this task. Many others have fulfilled all or nearly all their war contracts, and are on their own. Cutbacks and terminations of contracts inevitably mean some unemployment. That condition is disturbing and undesirable, and can best be minimized by speedy resumption of civilian production.

There are, however, some serious obstacles to putting that happy solution to work. Shortages of many materials is one. Delays in getting new equipment is another. Government policies may or may not help.

Maintenance obviously has no control over some of these matters. Nevertheless, there is much it can do to put its plants in position to take quick advantage of every good break. Much maintenance of buildings and equipment has been deferred. This work can be gotten out of the way, pending the arrival of needed equipment or supplies. New lighting can be installed. Power and other service facility systems can be replaced, relocated, or revamped, as needs dictate. The condition of all equipment that will be retained can be determined, and plans made for doing whatever is necessary to it, if for any reason it is not possible to do the work immediately.

No plant can afford to go into the post-war period with rundown buildings, worn or defective equipment, or inadequate facilities. Maintenance can and must see that it is not necessary to do so.

Put Safety First When Cleaning Equipment

FLAMMABLE SOLVENTS, gasoline for example, are very effective agents for removing oil and grease, but those who use them must never be allowed to forget that they present serious hazards.

With the ready availability of so-called safety solvents, and other materials such as carbon tetrachloride that are not flammable, there is little excuse for taking chances with anything else. Nevertheless, gasoline is always at hand and the temptation to use a pan or bucket of it for cleaning equipment or parts may be overwhelming.

It is not always realized that gasoline vapor is heavy and may travel a great many feet from the source. Hence a chance spark or flame anywhere near the place where cleaning is being done may almost instantly envelop the whole area in flame.

Also, it must be remembered that the vapors of volatile solvents, regardless of whether they are flammable, are more or less poisonous, may produce very serious effects when inhaled. Therefore ventilation, either natural or artificial, must be thorough, sufficient to keep the vapor content of the air below the maximum allowable concentration for continuous exposure. This essential requirement will also help to minimize the danger of explosion or fire.

Ventilation alone, however, no matter how good, cannot prevent fire when flammable cleaners are used. That hazard must be met by the use of safety containers, elimination of every source of spark or flame in the area—in short, the strict observance of every precaution that experience has shown to be necessary and effective.

Fluorescent Lamps Also Can Cause Glare

GLARE from any light source, no matter what it may be, is bad. It can be, and should be, prevented. The best time to take whatever measures are necessary to prevent it is when the installation is put in.

Many plants are installing, or planning to install, fluorescent lighting. This comparatively new type of lighting, which already has been widely adopted by industry, has several advantages that appeal strongly to plant men. However, it can be, sometimes is, poorly applied. Complaints and dissatisfaction are the result.

It is no secret that many complaints have been made about fluorescent lighting. In a recent issue of *Illuminating Engineering*, the causes of these complaints are discussed at some length. The symptoms listed in these complaints include eye fatigue, scratchy sensation of the eyelids, watering of the eyes, mild headaches.

It has been suggested, and believed by some, that the spectral characteristics of fluorescent lamps are the cause of at least some of the complaints. Authorities do not agree on this point. In any event, it will have to be threshed out and settled by those who are competent to decide.

There is no argument, however, that bare or inadequately shielded lamps may produce annoying glare. And long experience has proved that glare can produce distinctly unpleasant effects.

When installing a fluorescent lighting system, or altering an existing one, it will be decidedly worth while to make sure that the job is properly engineered.

Neglect to do so may well result in failure to get all the advantages of this admirable light source.

Standardized Materials Cut Plant Housekeeping Costs

H. M. BRADLEY, Plant Engineer, Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

THE SMALLEST SAVINGS are an inducement to improved operation. It always seems that there are no further possibilities for improvement but, when all the facts are dragged out in the daylight, it is surprising what can be found.

So it was when Manning, Maxwell & Moore, Bridgeport, Conn., started to scrutinize plant housekeeping. The first step was to analyze the materials being used by matrons and porters, to see if best results were being obtained with the least amount of money and energy expended.

This analysis brought out the fact that porters and matrons had their own preferences for some particular sanitary cleaning products. As a result, when all the inventory cards were checked, the usual accumulation of odds and ends of material showed up, located in several department stockrooms, but all representing money tied up in inventory.

Setting Standards

The next step therefore was to set up standards for proper material and for its economical use. A representative of a national sanitary concern was called in to make an independent survey of the plant, and to make written recommendations.

After the recommendations had been submitted to the plant engineer, and had been gone over so thoroughly that they were whittled down to bare essentials, it was decided to eliminate 21 items, retaining original materials that had proved most successful in operation.

Even then some of the items were

Insecticide with a pleasing odor is used regularly in cloakrooms, smoking rooms, cafeteria. Workers feel quite confident that their clothes may be left in any area without fear of "little visitors"

Washrooms get a thorough daily cleaning. Anything left on the floor is put in containers, called "Lucky Buckets." The idea is that, once thrown in the bucket, the owner is lucky if he gets his property back. The floor stays surprisingly free of miscellaneous personal articles

Cleaning Supplies and How to Use Them

Supplies for Porters

5-gal. jug of cleansing deodorant
Germicide
Cleaning paste
Lusterizing oil
Cleaning powder
Pail
Pitcher
Bowl swab
Urinal swab
Pair of rubber gloves
Broom
Hand brush
Mop and pail
Cheesecloth

Supplies for Matrons

Germicide—odorless
Lusterizing oil
Cleaning paste
Bowl swab
Pair of rubber gloves
Mop and pail
Rags and cheesecloth
Hand brush

Cleaning Equipment Available to Matrons and Porters

Vacuum cleaners for rugs
Heavy-duty polisher and waxer
Exhaust vacuum cleaner for aisles
Mechanical scrubber
Exhaust and suction blower

Cleansing Deodorant

Use as is, every two weeks, on the inside of all toilet bowls and urinals. Use in pitcher with bowl swab and rubber gloves

Germicide

Mix ½ cup of germicide to a ½ pail of water. Use daily to wash inside and outside of all toilet seats, urinals, and toilet bowls. Wash all painted walls and partitions every day, including all floors in shower stalls.

Mix 2 ounces to 1 gallon of water for foot baths

Lusterizing Oil

Use this oil lightly without dissolving or mixing. Use it as a dressing on all partitions and metal fixtures. Can be used for cleaning water coolers

Cleaning Powder

Mix ½ cup of powder to a pail of water. Washes all types of floors

Furniture Polish

Use lightly on all furniture with cheesecloth until it has covered the entire surface of furniture. Use dry cloth as second process for a finished, polished effect

Liquid Wax

Be sure the floor is clean before applying wax. Then use either the wax applicator or a piece of cheesecloth. This is a self-polishing wax, therefore it is not necessary to rub. Lightly spread a non-slip dust material on the waxed floors to prevent slipping. Sweep up non-slip dust material so that all visible signs of non-slip material disappear

Oily Floors

Use oil absorbent material in fairly large quantities when first applied on oily floors, and then proceed to cut this quantity down daily to the smallest amount possible. Do not permit material to remain on floors too long without sweeping up and resprinkling again very lightly

Wet Floors

Use universal oil and water absorbent material. Keep changing material as warranted. Use same method as outlined for oily floor conditions

Dust Layer

Use sparingly for best results

duplicates, achieving like results in cleaning. Therefore, when all old stock had been used, five new items were ordered, which cover the entire range of industrial porter cleaning service.

The third step was to instruct all workers in the proper use of the materials. They were first shown what to use and how to use it, then requested to demonstrate to the supervisor and the sanitary engineer. Next they were all given typewritten instructions, so they would not forget what the material was to be used for or how to use it.

One particularly good result was noted from a lusterizing oil used to dress partitions. Even though plant housekeeping was usually very good, occasionally someone would write on the walls. The lusterizing oil can hardly be noticed, but pencil and chalk will

Matrons take care of the women's lounges. There are four matrons and thirteen porters for 200,000 square feet of factory space

Rubbing posters lightly with lusterizing oil prevents their being "improved" by the artistic efforts of workers armed with pencil or chalk. It is interesting to note that the lower posters are placed on the walls in the lavatories or about the plant, the less likely they are to be marked up

not register and the walls are free from markings.

It was interesting to note also that in placing notices in lavatories and about the factory, the lower a sign is placed the less likely it is to be marked up. A standard height of 4 feet was adopted as the one best seen and least mutilated. Rubbing these notices lightly with the lusterizing oil makes them, too, difficult to disfigure. The effect of nice, clean signs about the factory is pleasing.

Every week all cloakrooms, smoking rooms, and the cafeteria, are sprayed with insecticide. This is done with a small electrical compressor-type expeller that can be plugged into any 110-volt socket. It expels a fine vapor, which has a pleasant odor, and has proved successful in controlling pests. This work is done under supervision of the supervisor of all porters. The direct result is that the plant employees know that their clothes can be safely placed in any area.

The purchase of this small hand portable unit and the cost of servicing the various departments is about one-half of what it formerly cost to have outside exterminators do the same job.

Careful Scheduling

By proper scheduling of work, it was possible to reduce from six to four the personnel who cleaned the 30,000 square feet of office area. The extra two porters took over newly acquired areas made necessary by increased production. No additional personnel were required and the new departments had the benefit of trained porter service, with little or no supervision.

The entire factory was then divided into sections. The total area to be cleaned was 200,000 square feet, divided among a working force of seventeen porters and four matrons.

Now each employee knows what he is responsible for and what is expected of him. He knows a daily inspection is made by his supervisor, a weekly one is made by the plant engineer, and a monthly one by an outside sanitary engineer. Therefore, his cleaning standards must be kept up.

The net result is most satisfactory to management. It has a housekeeping program that is economical and consistent. The employees have a cleaner place in which to work. And the porters and matrons have a job so laid out that they know what to do, what to use, and when and how to use it, and the satisfaction of a job well done.

EVERY MONTH, AMONG THE ADVERTISING PAGES, these valuable aids to low-cost production: the plant operation man's guide to WHAT'S NEW IN EQUIPMENT (page 164) . . . a summary of LABOR DEVELOPMENTS (page 220) . . . things YOU WANT TO KNOW more about (page 208)

Cheaper to Remove Blackout Paint Than to Reglaze

MARTIN J. O'MARA, Superintendent of Maintenance, and EDGAR M. BRENNEN
Foreman of Buildings & Grounds, Eclipse-Pioneer Div. of Bendix Aviation Corp., Teterboro, N. J.

REMOVAL OF WARTIME BLACKOUT COATINGS on the exterior and interior surfaces of most of the glazing in the ten buildings of Eclipse-Pioneer in Teterboro, N. J., and adjacent communities presented a problem as to the best and cheapest method available. Approximately 342,600 square feet of glass required cleaning. A variation of only 1 cent per square foot in the cleaning cost would involve a difference of more than $3400.

Which was cheaper, cleaning or reglazing? The determination of the cost of reglazing was simply a matter of getting professional estimates for the job. Based on an estimate of slightly over $87,200, the cost per square foot (for one side, to afford comparison with cleaning cost) was 25.4 cents for all labor and material involved in removal of painted glass and reglazing.

Cleaning Costs Unknown

No one outside the company seemed to have any specific knowledge of what costs were involved in cleaning. Professional window-cleaning companies have naturally done little work of this nature up to now, and their estimates varied all over the lot.

Fortunately, in the problem of arriving at a dependable estimate of the cost of this work to submit to management, Eclipse-Pioneer had some background of experience in blackout removal. About 2 years ago a revision in plant layout involved the transfer of the production-drafting department to a building originally occupied by manufacturing departments. It therefore became necessary to remove the blackout paint from much of the glass in that area.

In the course of this work it was discovered that removal of blackout in these buildings was not as simple a procedure as originally anticipated. Both the construction of the glass and the nature of the blackout application presented difficulties. About three-quarters of the area of glazing in the entire plant is hammered glass, with a pebbly surface on the exterior, and a smooth interior surface. The bal-

A semi-paste material is first applied to the outside of the windows to loosen both coats of blackout paint. Next comes a scrubbing with a brush and lukewarm water, followed by a thorough hosing

ance of the plant is clear smooth glass.

The blackout applied to the exterior surfaces in the latter part of 1942 consisted of two coats. The prime coat was a brush-coat of black paint of asphaltum base, to prevent "blistering" and "raising." Over this was a brush-coat of olive drab oil-base paint, to make the appearance of the glass conform to the camouflage colors applied to other parts of woodwork, steel, and brickwork of the buildings. This second coat also helped to prevent peeling.

The interior of all blackout glass was given only one brush-coat of oil-base gloss white, solely to improve the illumination of the plant. Generally speaking, most of the hammered glass is located in the sash of the one-story roof monitors of the various buildings, while the clear glass is located in the first two or three rows of lights in ground-level sidewall sash. Glazing at higher levels of sidewall sash is of the hammered type.

In the original attempt to remove the exterior blackout, it was found that it did not come off as easily as anticipated. Various solvents for oil-base and asphaltum-base paints were tried, such as kerosene, varsol, mineral spirits, naphtha, and gasoline, but without much success. They would not soften the coating, and they evaporated too quickly. Peeled parts came off, but in general the blackout had been baked on so hard by the sun that the ordinary thinners would not penetrate. Scrubbing with wet cloths or wire brushes, after applying the solvents, was not helpful. A flexible-shaft power-driven wire brush machine was tried, and did the job successfully, but it was able to do such small areas at one time that the cost was prohibitive.

A Difficult Job

In the case of hammered glass, the pebbly surface made the removal job more difficult, because the thickness of the paint in the low spots was several times that in the high spots. In consequence, the solvent would soften the high spots sufficiently for removal of the paint, but it would evaporate too fast to penetrate the low spots.

At this point of failure to develop an economical method for blackout removal, it was decided to call in an outside specialist in chemical removal of paints. This consultant at first concluded that a combination of two removers would be needed, one each for the oil-base and asphaltum-base paints. Panes of hammered glass were removed from the monitors and taken to his experimental laboratory.

After 3 months of testing, a "remover" was developed that loosened the exterior blackout coating but left the mixture in a muddy condition on the glass. This mixture required a second cleaning with ordinary benzol cleaner to remove the "remover," and then a third cleaning by a regular window washer to remove the film left by the second cleaning. On this basis, labor costs were still too high to compete with the cost of reglazing.

After a further period of experimentation, a product was finally developed by the consultant that simplified the blackout removal procedure. In semi-paste form, it is applied with a brush, let stand for about 15 minutes, and then the surface is scrubbed with an ordinary scrubbing brush, using lukewarm water. These operations are immediately followed by liberally hosing the surface with clear lukewarm water. The glass is left clear, without any spots. Inspection of the roof after substantial use of this cleanser shows no ill effects from the drainage. Only ordinary workgloves need be worn by the workmen.

Another commercial paste product was also discovered that is equally effective in removing the oil-base white coat on the smooth interior glass surface. It, too, is brush-applied, but causes the paint to blister so it can be scraped off with a putty knife. The surface is then washed with warm water and squeegeed. Because this paste does not require flushing, this method has no disruptive effects on production.

To remove the oil-base white paint on the smooth interior glass, a paste product is brushed on, causing the paint to blister so that it can be scraped off with a putty knife. The surface is then washed with warm water, and squeegeed. No water spots or streaks remain

Removal Costs

Using these two methods for removal of exterior and interior blackout surfaces, the cost of direct labor and materials (not including supervision) for blackout removal has been determined. Based on recent experience with 14,000 square feet of hammered glass, the average cost per square foot (based on one side) was 15.5 cents. It is felt, moreover, that on the basis of greater efficiency possible with large-scale organization, this unit cost can be lowered to at least approximately 10 cents.

It is true that the glass cleaning process also removes the paint from the sash, which might be taken to indicate that the cost of repainting the sash should properly be included as an added charge. Against this, however, is the belief that reglazing also requires repainting of sash. Moreover, the fact that the olive drab camouflage was soon to be removed, and also that the sash was scheduled for a repainting as a matter of good maintenance anyhow, eliminated this consideration.

Underground Plant Saves Fuel and Upkeep Costs

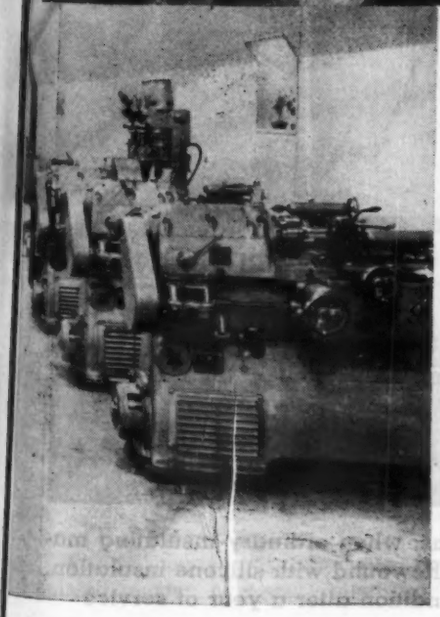
A BOMBPROOF, GASPROOF, and practically fireproof industrial establishment has been constructed in the Swedish hardware manufacturing city of Eskilstuna. Belonging to the Swedish machinery firm of Bolinder-Munktell, it is a large engineering workshop situated in a vast hall blasted out of the solid granite rock. Here is a war-born experiment which may lead to the construction of similar establishments even in peacetime.

Although it is entirely located inside a rock, the interior of the workshop is light and airy. The rock walls are not visible, being covered with light-painted pressed-wood board. The machinery also is painted in light, harmonious colors.

Here and there in the walls are small rectangular niches with intricately illuminated artificial flowers and an artificial outside "sky," giving a semblance of real windows. The pleasant impression is heightened by many daylight lamps.

An effective air conditioning system continually supplies the workshop with fresh filtered air at a suitable temperature and degree of humidity. The premises are thus practically unaffected by the changes of the seasons, avoiding both the close and damp summer heat and the winter cold. The rock is an excellent heat-insulator which, if the premises were not artificially heated, would keep the air at a temperature of about 45 deg. F., independent of the outdoor temperature. The creation of heat from machines, ovens, and electric installations is, however, sufficient to maintain the temperature constantly

It is hard to realize this plant is entirely underground. The rock walls are covered with light-painted pressed-wood board, with small niches to represent windows. Fresh air is supplied by an air conditioning system. The rock acts as insulation, keeps the plant cool in summer, warm in winter



Right into the side of the rock go the excavating machines, preparing the way for an underground factory that is fireproof, bombproof, gasproof—but is still a pleasant place to work

at about 70 deg. F. under normal winter conditions. Indeed, the biggest fuel cost will be incurred during the summer, when the premises will sometimes have to be cooled by electric apparatus.

If the district should be subjected to a gas attack, the premises could be entirely closed, thus protecting workers against poison gas. In case of fire, the premises can simply be evacuated and closed, which would cause the fire to die out for want of oxygen. Furthermore, the plant has its own water supply from a diamond-drilled well in the rock floor. Recorded music is played during the working hours.

Surprisingly enough, this workshop has not cost much more than a similar factory above the surface. By making the premises so big that modern excavating machines could be used inside, the cost per cubit meter for the excavated rock was greatly reduced and, in addition, reinforcing iron and cement have been saved.

It is expected that the maintenance costs will be low, and the great fuel economy of the establishment is another important item. It is too early yet to decide how working entirely under artificial light will affect the workers, but so far no unfavorable observations have been made.

Windings That Resist Heat

G. A. VAN BRUNT, Associate Editor, *Factory*

MUCH PROGRESS has been made in producing electrical insulation that is more resistant to heat, moisture, corrosive chemicals, and solvents. This progress has been furthered by comparatively new compounds known as silicones that have recently come into prominence as impregnating materials for motor and other windings.

Efforts to improve the characteristics of insulation have been unremitting since the days when electrical equipment came into commercial use. For a long time only paper, cotton, silk, with oil-and-gum insulating varnishes were available as insulating materials for windings. These are primarily carbon compounds, known as organic materials. Such compounds tend to char and disintegrate under the influence of heat. That process may be rapid or slow, depending largely on the temperature. The relation between the life of insulation and the operating temperature was recognized many years ago.

Despite the tendency of organic insulating materials to deteriorate under high operating temperatures, so-called Class A insulation serves quite satisfactorily in many applications. Countless motors, for example, with Class A insulation have given 20 years or more of satisfactory service, when conditions were favorable.

Unfortunately, there are many places where the operating conditions are not favorable. High ambient or operating temperatures cannot always be prevented. Also, there may be severe exposure to excessive moisture or corrosive fumes or materials.

In time mica came to be used for motor slot insulation. Then asbestos-covered wire became available. More recently glass-insulated wire and glass tape and cloth were put on the market. All these materials, known as Class B, have been of great help in producing longer-lived windings. Nevertheless the insulating varnishes with which windings must be treated in order to stiffen and seal them, were still a weak spot, so far as resistance to tempera-

Attack by organic solvents and moisture, plus the heating caused by initial overloads, limited the service life of the motor driving a batch centrifuge to less than six months, when ordinary insulating materials were used. Rewound with silicone insulation, it is in excellent condition after a year of service

ture is concerned. When these organic impregnating materials deteriorated, the moisture-resisting qualities of the winding were impaired.

Some time ago chemists produced compounds to which the name of silicones has been applied. They may be regarded as semi-organic materials in which organic or carbon groups are attached to a heat-stable skeleton of silicon-oxygen-silicone linkages similar to that found in sand, quartz, and glass. There are a number of these organo-silicon compounds. In general they are characterized by chemical inertness, and resistance to heat and oxidation. In addition, they are non-corrosive to metals, and are not affected by water, dilute acids, or salt solutions. These properties naturally suggested the use of certain silicones as impregnants for windings.

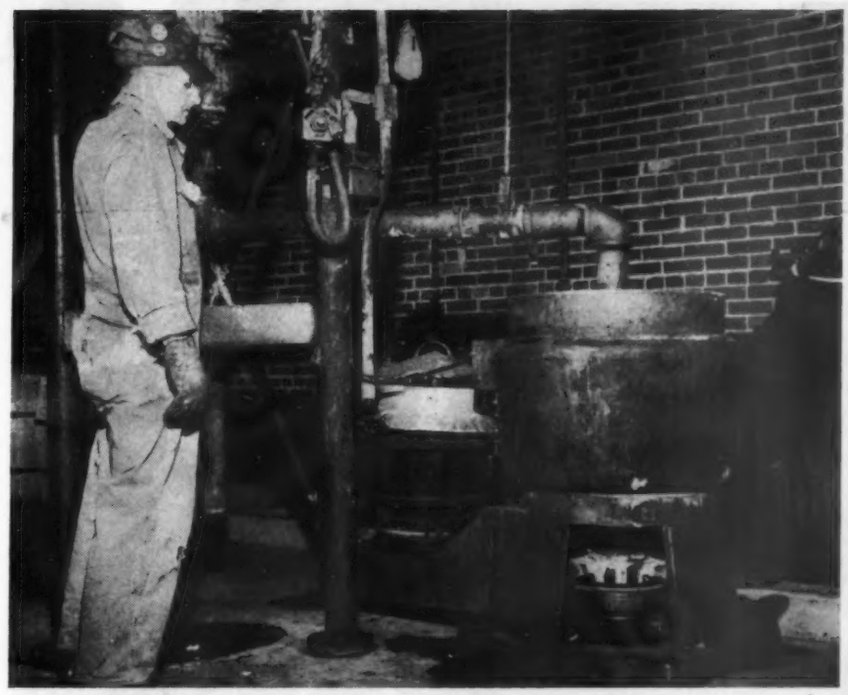
Silicones have been developed on a commercial scale by The Dow Corning Corporation, Midland, Mich. They have been used in place of other insulating varnishes on motors operating under severe service conditions in manufacturing plants of the Dow Chemical Company. The following information on the results obtained with these materials has been made available by Walter Rupprecht, superintendent of the Dow electrical department.

The most serious problems have revolved around the insulating materials used in motors and other electrical equipment. Insulation is exposed to all kinds of chemicals that deteriorate it. Some oxidize the insulation and destroy it. Others, such as calcium chloride, accumulate on the insulation, and dissolve in moisture taken from the air. Still other materials are solvents that dissolve the varnish and weaken the insulation. Insulating materials must therefore withstand acids, bases, salts, solvents, and moisture, in addition to heat caused by overloading or by high ambient temperatures.

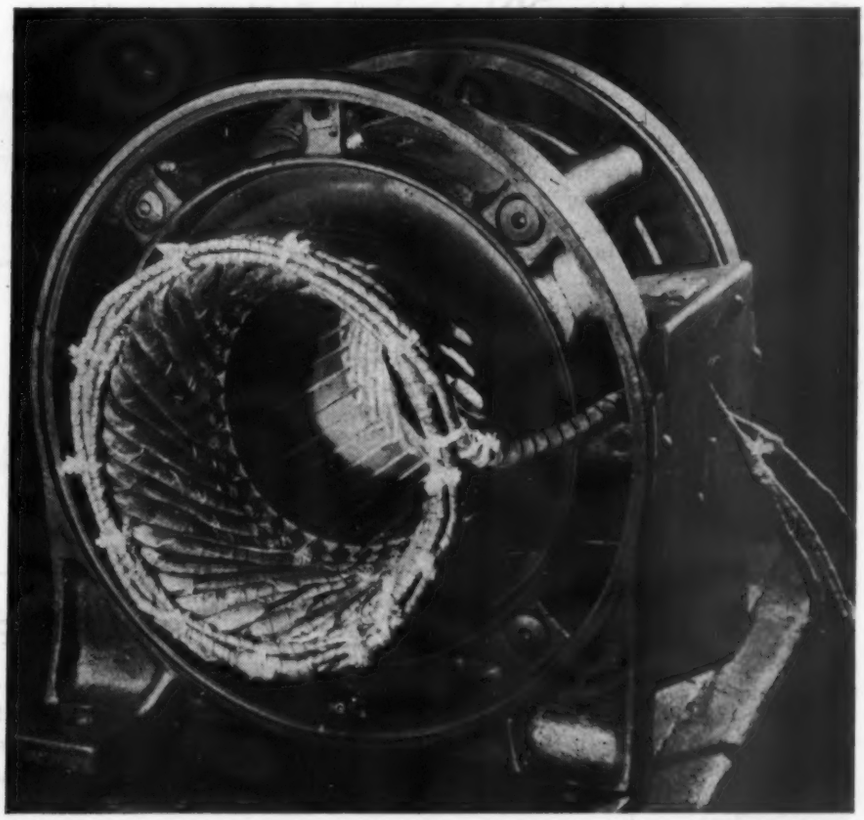
Results of Test

About two years ago, it was decided to give a new silicone impregnating varnish a test under regular operating conditions. Silicone-bonded, glass-served magnet wire, mica-glass slot liners, and glass tape were obtained from several fabricators who were experimenting with the silicone varnish. Several motors were wound, using these materials, and impregnated with silicone varnish. Most of these motors are still in operation and more than a dozen others have been rewound since that time.

The silicone-impregnated glass-insulated magnet wire was smooth and



Motors driving centrifuges in one of the crystallizer rooms are often overloaded. If the thermal overload protection took the motor off the line, a ten-minute delay resulted. After rewinding, the overloads could safely be reset to a higher value, reducing delays



Rewound with silicone insulation throughout, the stator of a 20-hp. motor is ready for final dipping. When impregnated with an earlier type of silicone varnish, it carried 100 percent overload for fourteen days and a 50 percent overload for nine months in an extremely wet location. In sharp contrast to this record, under normal load ordinary insulation lasted less than nine months

With Class B insulation this 7½-hp. motor, direct connected to a centrifugal pump, lasted from six to nine months. Besides being subjected to overloads, the motor is frequently hosed off to remove salt deposits. It was rewound two years ago, and is still in service

gave the winders no trouble from unbonded glass fibers. To lubricate the wire and prevent chafing of the glass insulation, the surface was wiped with Dow Corning fluid. Mica-glass sheet insulation was used for the slot liners and phase insulation. Coil separators were made by laminating several thicknesses of silicone-varnished glass cloth together with Dow Corning silicone resin. Silicone-varnished glass tape and sleeving were used throughout, and all tying was done with glass cord.

The stators thus wound were impregnated with silicone varnish, following the same procedures established for organic varnishes. The varnish baking oven was used for removing the solvent from the silicone-impregnated winding. To get the temperature required for baking the silicone varnish, the heat in a certain oven was reduced to 500 deg. F. The baked stator was then redipped and baked again to give the desired thickness of varnish coating.

In the Midland plant more than 6000 three-phase motors are used in all kinds of services. Most of them are connected to non-shock loads, such as pumps and fans. Many are overloaded, however, and many others must operate under difficult service conditions. Several overloaded motors that failed every few months were rewound with silicone insulation. For example, one of the rewound motors is rated 7½ horsepower, but it is connected to a 10-hp. load in a continuously wet location, pumping epsom salt solution. This motor formerly had a service life of from six to nine months. After being rewound it is still in service after two years of continuous use.

Another motor rewound as described previously is a 20-hp., 3600-r.p.m. fan motor, located on top of an oven for heat-treating Dowmetal. It has a hard starting cycle along with a high ambient temperature. This motor has been driving a 30-hp. load about four months. Like this one, many of the fan motors are located on top of ovens and take only from seven to ten minutes to get up to temperature. In this period they are overloaded from 50 to 100 percent, depending upon the fan design. So far as can be determined, this motor is standing up perfectly.

Longer Life Expected

A recent rewind job involved a motor that drives a batch centrifuge. It was failing too frequently, causing costly shutdowns in one plant. There is every expectation that silicone insulation, because of its greater chemical resistance, will give longer life on this job.

It is planned to rewind another motor driving a continuous centrifuge with silicone insulation. This motor is rated 10 horsepower but takes up to 30 horsepower in the three to four minutes required to get up to full load. It is usually smoking hot by the time it gets up to speed.

The experience thus far with silicone insulation has been very promising. Longer life has been obtained from the first experimental jobs rewound with this kind of insulation than any other insulation has given in troublesome applications.

Although the motors get hot under heavy overloads, no smoking takes place, and no heat damage results. As a consequence, if the motors get wet during shutdowns or clean-up periods no moisture can penetrate.

In view of this experience it is planned to rewind most of the integral horsepower motors with silicone insulation as soon as the necessary magnet wire, slot liners, slot sticks, and silicone-varnished cloth tape and sleeving can be obtained.

SAVE PAPER NOW

Victory in Europe in no way lessens the need for waste paper salvage. In fact, the need is greater now than ever before. War materials being sent to the Pacific war area require even greater protection than those that went to the European theater. Supplies of pulp are lower. Labor to cut lumber is no easier to get. And the transportation situation is tighter than ever. Do your part to hasten V-J Day by saving every scrap of paper you can—by eliminating unnecessary paperwork, by cleaning out your files, and by cooperating with your local waste paper drives.

How to Move Machines

G. R. LEGGETT, Mechanical Superintendent, Scovill Manufacturing Co., Waterbury, Conn.

A VARIETY OF METHODS have been worked out over the years for moving large and small pieces of equipment at the Waterbury, Conn., plant of Scovill Manufacturing Company. In this plant there are many hundreds of machines of many types. These machines range in weight from a few hundred pounds to 200 tons or more. They may be only 2 or 3 feet high, or they may be 30 or more feet high.

Moving some of these machines from one place to another to meet changed production schedules or for other reasons is practically a daily chore. In addition, there is a considerable amount of dismantling of machines going on all the time, to renew worn parts, repair breakdowns, replace obsolete equipment, or prepare equipment for shipment to other Scovill plants.

All such moves must be made promptly, with minimum disturbance to production routine in the department affected, and, above all else, safely. To handle this work requires a crew of 65 millwrights and riggers. These men have had long training in handling heavy machinery, and the necessity for doing everything safely had been so thoroughly impressed on them that they automatically do their work in the safest possible way. There is no place in these crews for the chance-taker or careless man. As a result, injuries to personnel or damage to buildings or equipment incurred while moving or repairing equipment

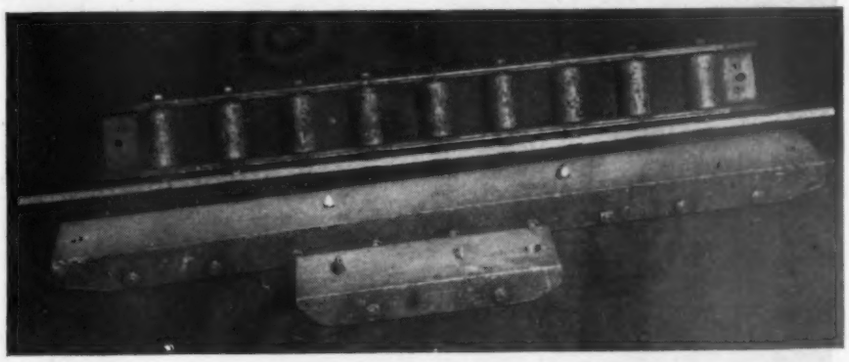


Figure 1. So-called roller skates find wide usage in moving machines. They are made in various lengths from pieces of channel iron. Rollers are ball-bearing. Heavy-duty skates will handle loads up to 35 tons

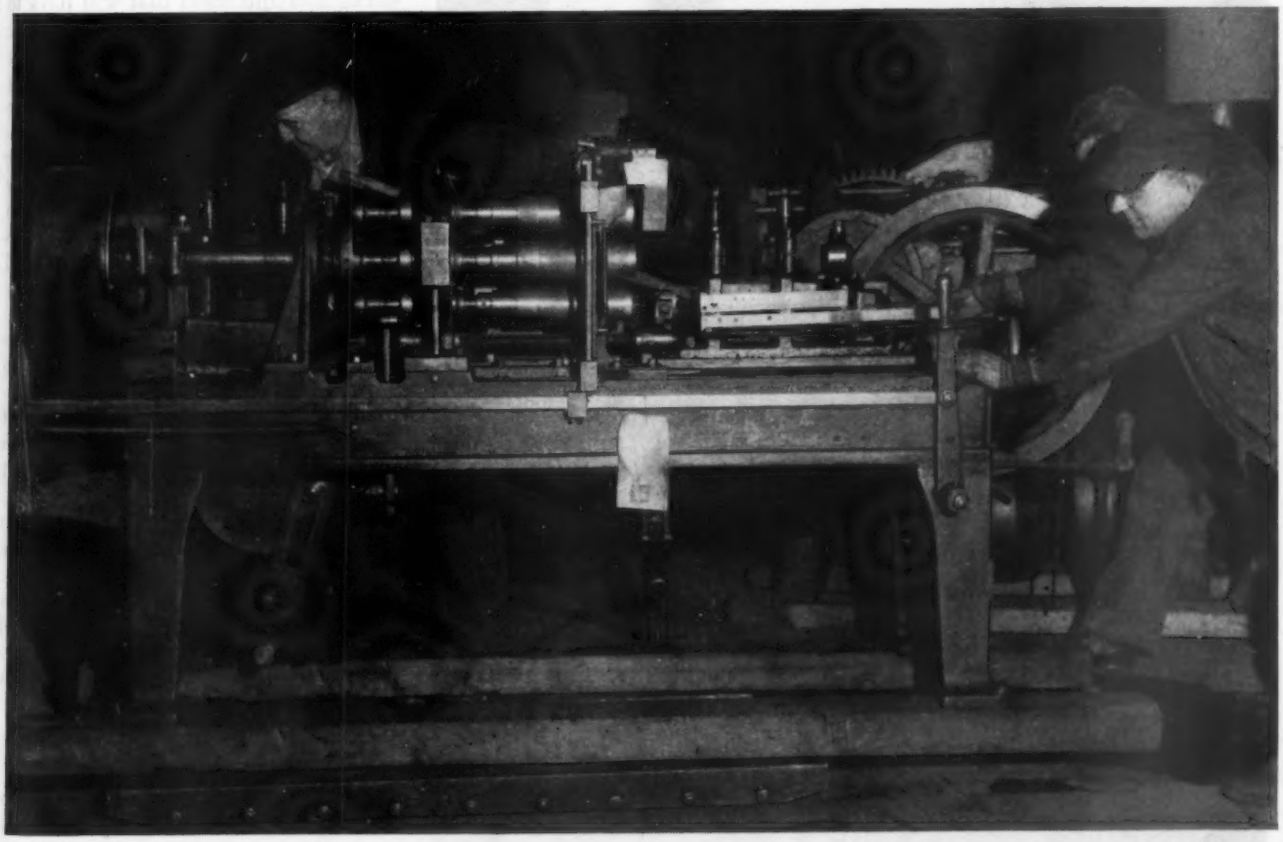


Figure 2. When skates are used, the machine is put on heavy wooden skids. Sharp steel points on top of the skates embed themselves in the skids and keep the skates from getting out of position

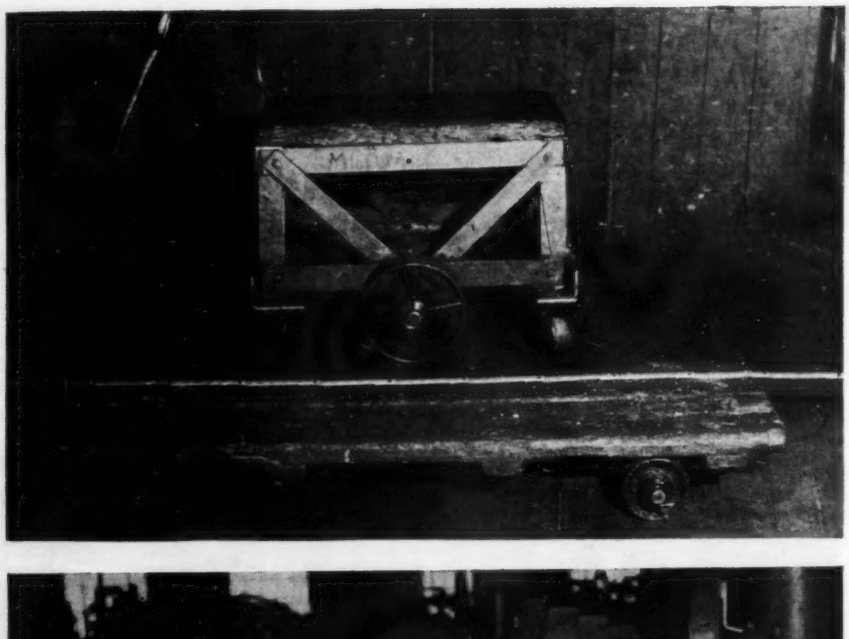


Figure 3. A low, narrow-gage four-wheel truck and a higher six-wheel truck also serve frequently and well. Swivel casters placed at the four corners of the six-wheel truck permit turning it in a very short radius

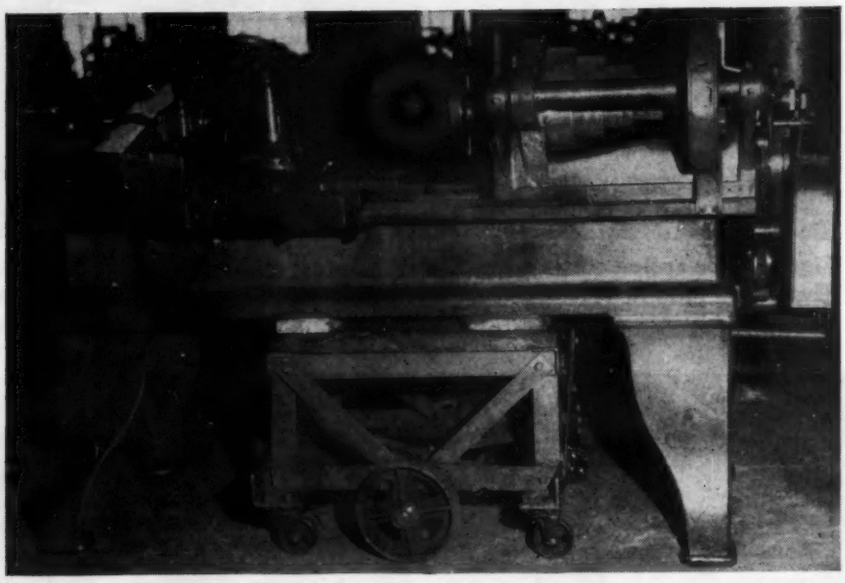


Figure 4. Moving a lathe is a typical job for a six-wheel truck. Tapered wedges raise the machine just enough for legs to clear the floor

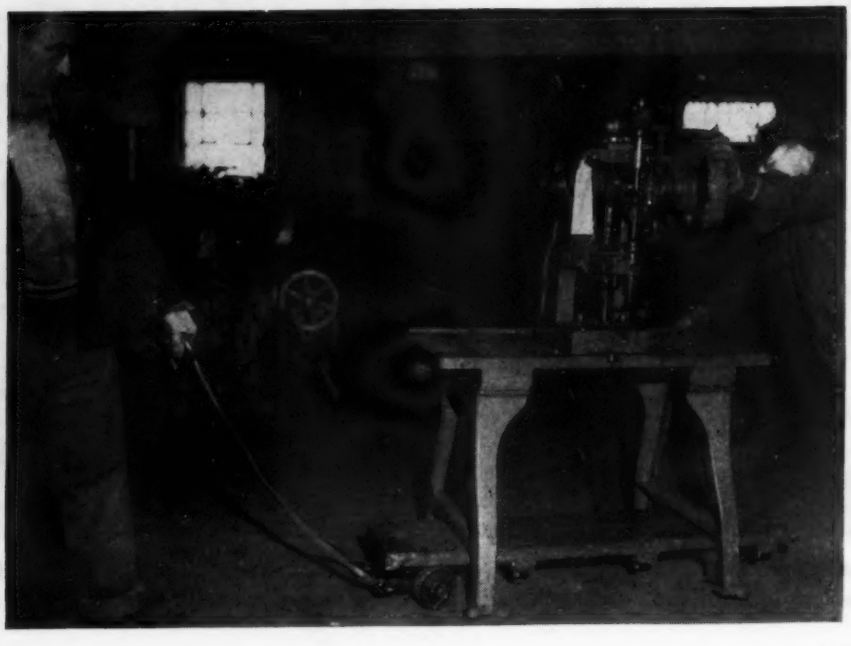


Figure 5. With a narrow-gage four-wheel truck, moving a small press is a simple matter. Here, too, the press is raised only enough for the legs to clear

are virtually unheard of at the Scovill Manufacturing Company.

Careful planning is absolutely essential to the safe and economical moving of machinery. The routine followed here is about as follows:

When a move order is received the weight of the machine is looked up or estimated. Notes are made regarding the method of driving it and whether air, gas, steam or water connections are required. The new location is surveyed to determine what work will be needed in the way of building foundations and erecting power and other service lines. The need for strengthening the floor at the new location is also investigated.

Route Is Planned

The route over which the machine is to be moved also is carefully planned. When laying out a route it is necessary, of course, to consider the strength of the floors that will have to be traversed. Width of doorways, the presence of building columns or other obstructions, and any other factors or conditions that will hinder the move must be looked into. Sometimes machines or other obstructions that are not a part of the building itself have to be moved out of the way and then put back. Decision must be made as to the equipment that will be needed to make the move, and how many men will be required.

Finally an estimate is made up covering the cost of every operation involved in the move. This cost estimate is submitted to the department that has ordered the change. Upon approval of the estimate the date is set on which the work is to be done. Naturally, every effort is made to do the work at a time when it will cause the least disturbance to production.

Preparation of the new location is begun well in advance of the actual move. Floors are strengthened, foundations are built, power and other lines are installed, so that when the ma-

chine is put in its new location it can be connected and put into service with the least possible delay.

As would be expected, several different kinds of equipment are used in moving machines. A highly useful type of dolly, known locally as a roller skate, is shown in Figure 1. These skates are essentially a piece of channel iron fitted with ball-bearing rollers. They are made in various sizes to handle weights up to 35 tons.

In Figure 2 is shown the method of moving a machine that has been mounted on wooden skids. It will be seen in Figure 1 that the skates have sharp steel points on top. These points embed themselves in the timber skids and thus keep the skates from shifting.

A narrow-gage four-wheel truck and a six-wheel truck are shown in Figure 3. The swivel casters at the corners of the six-wheel truck permit it to be turned in a very short radius. Both these trucks are very useful for moving machines of moderate weight.

In Figure 4 is shown how a lathe is mounted on the six-wheel truck. As will be seen, the lathe is raised with tapered wedges, just enough for the legs to clear the floor.

The four-wheel truck is used for moving small machines, particularly those whose construction makes it possible to use a low-slung device. Note

Figure 6. A low-slung three-wheel truck is well adapted for moving machines that have flat solid bases. A short turning radius is one of the obvious advantages of this truck

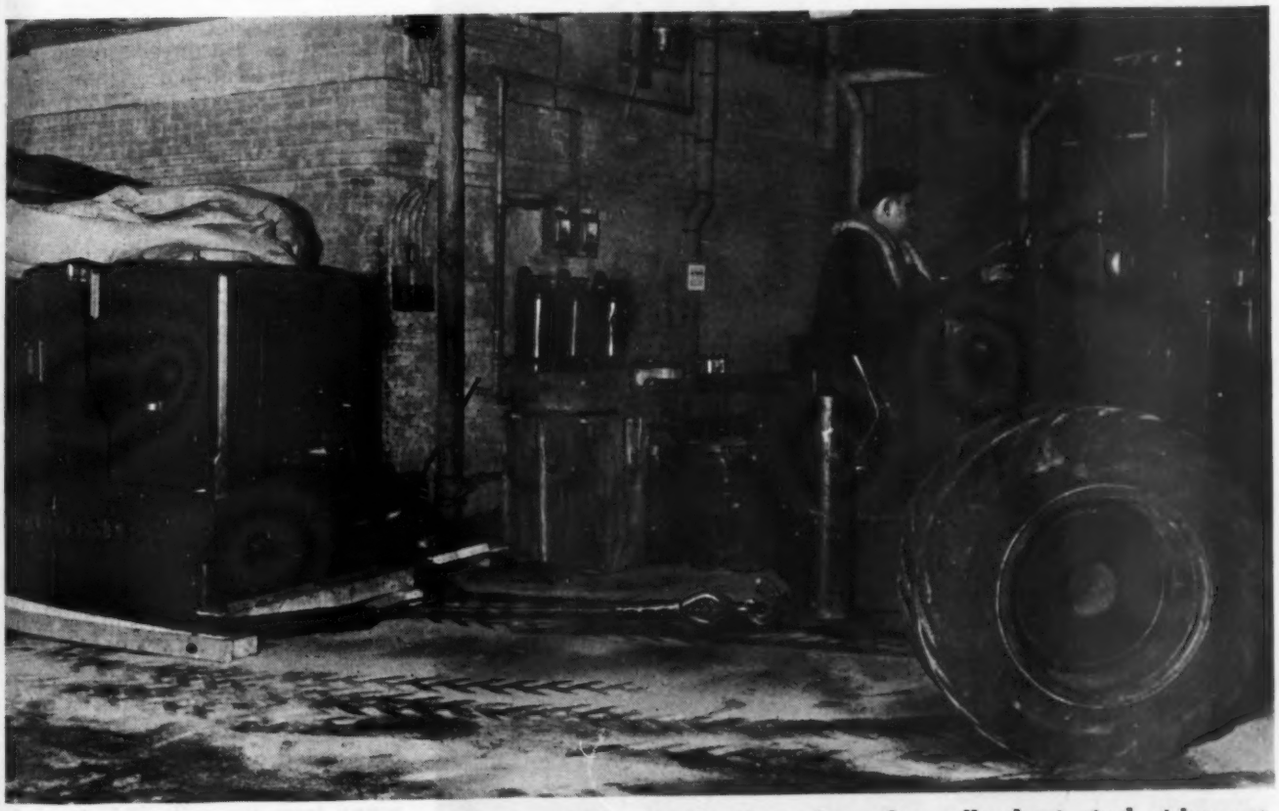
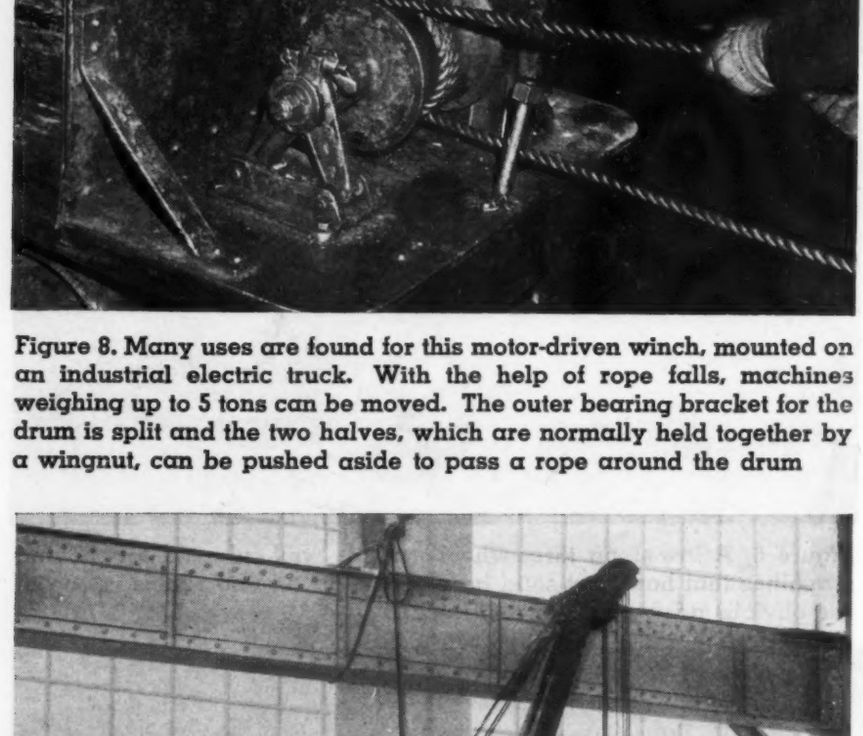


Figure 7. Heavy machines may be moved on skids by an electric truck, or by an engine-driven crane truck. To reduce the pull, sheet steel strips are placed under the skids and greased

Figure 8. Many uses are found for this motor-driven winch, mounted on an industrial electric truck. With the help of rope falls, machines weighing up to 5 tons can be moved. The outer bearing bracket for the drum is split and the two halves, which are normally held together by a wingnut, can be pushed aside to pass a rope around the drum



that the legs of the small bench press in Figure 5 have been raised just enough to clear the floor.

For moving machines with solid bases, a three-wheel truck, shown in Figure 6, is used. With its front swivel wheel, this truck can be turned in a small radius.

Frequently, it is easier and more convenient to drag a heavy machine on skids, rather than mount it on one of the trucks previously described. The length of the move, the weight of the machine, the surface over which it is to be moved, and the condition of that surface are all taken into consideration when deciding how any piece of equipment is to be handled.

When skids are used, the machine is dragged by an electric truck, or by a stronger engine-driven truck crane, as Figure 7 shows. When a very heavy piece of equipment is to be moved in this way, pieces of sheet steel may be placed under the skids and greased, to make the skids slide more easily.

In moving machines of excessive weight, steel rollers made of solid round bars or heavy pipe may be put under the skids to reduce the pull required.

If corners have to be turned or the machine being moved has to be maneuvered around some obstruction, it may be found that there is not enough room to accommodate both the machine and truck, so that the latter can exert a direct forward pull. In such an event one or more heavy pulleys are lashed to a building column or other solid support and the tow line is passed around them. Then the truck can pull the machine in the desired direction while moving at any angle.

A Special Winch

Shown in Figure 8 is an exceedingly useful piece of equipment. It is a standard industrial electric truck on which has been mounted a special motor-driven winch. Any weight up to 5 tons can be pulled by this winch through rope falls. Operated by one man, the truck saves both time and manpower.

The outer bearing bracket for the winch is split, the two halves normally being held together by a heavy wing-

Figure 9. This crane truck is often used when heavy weights have to be hoisted or lowered. Here it is lowering the bridge of a 5-ton crane from the rail. This truck is also used as a tractor, when heavy pulling is required

nut. When the wingnut is removed, the halves of the bracket can be pushed aside so that a rope can be looped around the drum. Then the bracket is replaced.

The engine-driven truck crane referred to before, and shown in Figure 9, also saves much time and labor. It has a lifting capacity of 2 to 6 tons, depending on the position of the boom. The boom can be lowered to approximately the level of the counterweight just above the operator, and therefore the truck can be used for pulling heavy weights in any places where there is only ordinary headroom.

There are many occasions when the truck with power-driven winch, shown in Figure 10, renders valuable service. The winch is a standard model driven by the truck's engine through a power take-off. As shown here, the truck is stationed outside with the winch cable pulling a load inside the building at the left, through snatch blocks.

Thus far only the methods of equipment used when machines are moved horizontally have been considered. Much of the machinery moving in this plant involves hoisting or lowering heavy weights a distance of 30 or 40 feet. Such work requires different equipment and technique.

Vertical Moving

When the weight to be handled does not exceed the capacity of the roof trusses it may be possible to attach chain falls to them and proceed with the work.

It frequently happens, however, that the weight to be handled considerably exceeds the load that can safely be put on the trusses. Under these conditions there are two alternatives: (1) Block up the trusses by I-beams resting on the floor or on some structural member, such as a crane rail girder; (2) use a special steel frame designed for this purpose.

One of these frames is shown in Figure 11. It will be noted that the four columns are of lattice construction. Heavy I-beams across the top of the column serve to tie them together. These beams also support another beam, seen at the top, on which is mounted a trolley carrying chain falls. Several of these frames are used in different sizes. They are bolted together and can readily be erected wherever needed, moved on rollers if conditions permit, or dismantled and put up where needed.

It is literally true that every machinery moving job presents new problems. Certainly, several important factors are almost sure to vary widely and make it necessary to change methods or equipment to fit them.

Figure 10. Machines can often be moved inside a building, with the minimum of disturbance of operation, by means of this truck-mounted winch. The truck is stationed outside while the winch cable is passed through a convenient door or window

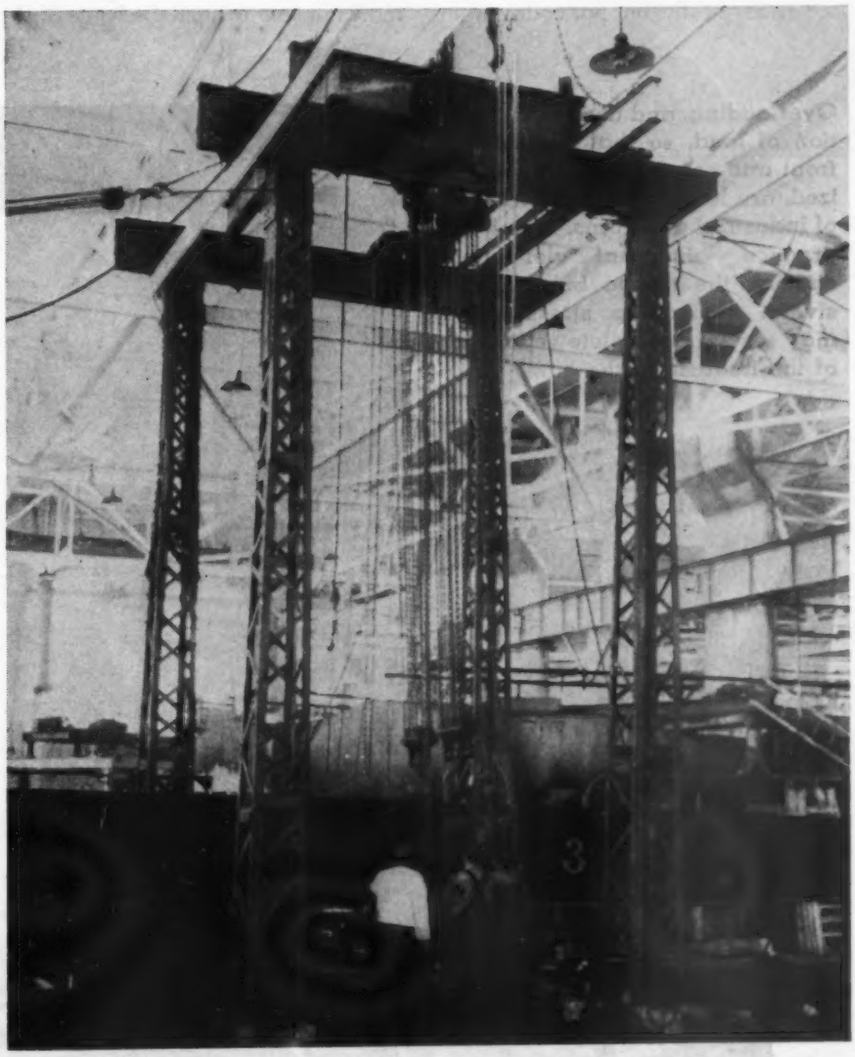


Figure 11. When heavy weights must be raised or lowered a considerable distance, use is made of a steel frame such as shown here. The lattice columns are tied together at the top by heavy I-beams.

How to Get the Most Out of Solid Rubber Tires

H. W. DELZELL, Field Engineer, Tire Division, The B. F. Goodrich Company, Akron, Ohio

SOME DIFFICULT PROBLEMS have been presented by the use of synthetic rubber in industrial solid tires for electric or gas power-driven trucks and trailers commonly operated in factories, warehouses, loading docks, and ports of embarkation.

There are two general types of these tires, the "press-on" type, which is vulcanized to a steel base and applied by hydraulic pressure to a wheel; and the "vulcanized-on" type, vulcanized directly to the wheel. The former are used mostly on power-driven industrial trucks and the latter on hand-operated or trailing vehicles.

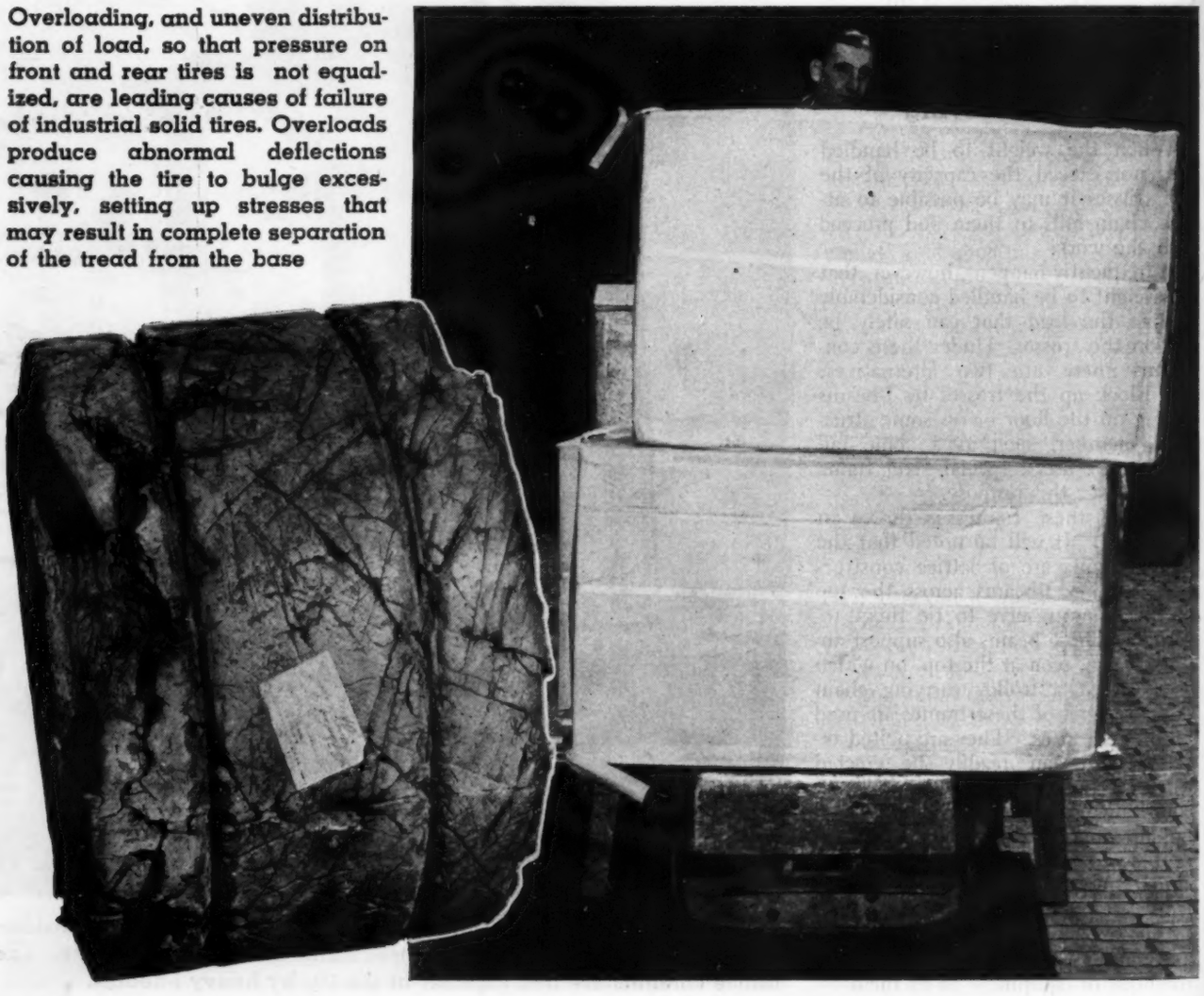
The use of synthetic rubber in both of these types of industrial solid tires increases rolling resistance and power consumption; reduces the toughness and resistance to cutting, chipping and wear; and lessens the adhesion or bond between the tread and the base.

The increase in rolling resistance is quite serious, particularly in the case of battery-operated trucks, in that the additional power consumed by the tire results in a more rapid discharge of the batteries, and consequently more frequent recharges are required for a given period of time. This increased rolling resistance also reduces the speed of the vehicle.

Tests have proved that by the use of synthetic rubber the rolling resistance is increased approximately 40 percent over the pre-war crude rubber tire; and at the same time, the resistance to chipping and cutting is reduced by approximately 10 percent.

This means that where a tractor on crude rubber tires could operate for

Overloading, and uneven distribution of load, so that pressure on front and rear tires is not equalized, are leading causes of failure of industrial solid tires. Overloads produce abnormal deflections causing the tire to bulge excessively, setting up stresses that may result in complete separation of the tread from the base



By operating over rough or uneven runways, railroad tracks, or curbs, impacts are produced which may injure the bond and produce base separation. Mechanical irregularities in trucks, such as sprung axles, misdligned casters, and bent tie rods, also produce undercutting, separation, or uneven tread wear

ten hours without a battery recharge, it could only operate for six hours on synthetic tires, and at reduced speed. By special compounding, it has been possible to produce rolling resistance in a synthetic industrial solid tire to equal that of the standard pre-war crude rubber tire; but to accomplish this, it is necessary to reduce the toughness of the tread, so that the synthetic tire will give only about 80 percent of the service life.

Low rolling resistance, or power consumption of the tire used on battery operated trucks, is so important that it has been found economical to use the lower power consuming tires at a sacrifice of toughness in the tread and a reduction in over-all service life.

These deficiencies, in many cases, can be offset to a substantial extent by better care of the tires. Probably no tires are more abused than the industrial solid. The greatest cause of failure in these tires is from overloading.

Overloads produce abnormal deflections, causing the tire to bulge excessively, setting up stresses and a localized flexing action just above the steel base or wheel. This results in so-called undercutting, which ultimately produces either a chunking out, in which a strip of tread circumferentially around the tire falls out, or it may result in complete separation of the tread from the base.

Overloading will also produce separation by increasing impact when running over obstructions. These impacts are transmitted to the base, injuring the bond and starting separation between the tread and base which eventually results in the whole tread falling off.

Power consumption is also increased with overloads on the tire.

The carrying capacities of industrial solid tires have been set up on the basis of deflection under a given load for tires of the different sizes when operating at a maximum speed of 8 miles per hour. These ratings were established, from experience, to give

maximum service life under average operating conditions. If loads or speeds above these recommendations are imposed on the tire, it is at the sacrifice of tire life.

The next most important cause of industrial solid tire failure is from operating the truck over improperly kept or rough floors and runways.

Under such conditions the tire may fail from cutting and chipping the tread in running over sharp pieces such as metal, nails, bolts, lathe trimmings, glass, or stone. These pieces may also be picked up by the tire and eventually work through the tread to the base, injuring the bond and resulting in separation.

By operating over rough or uneven runways, such as railroad tracks or curbs, impacts are produced which may injure the bond and produce base separation.

Injury to the bond will also result from hitting obstructions and bending the base at the edge, producing a starting point for ultimate failure.

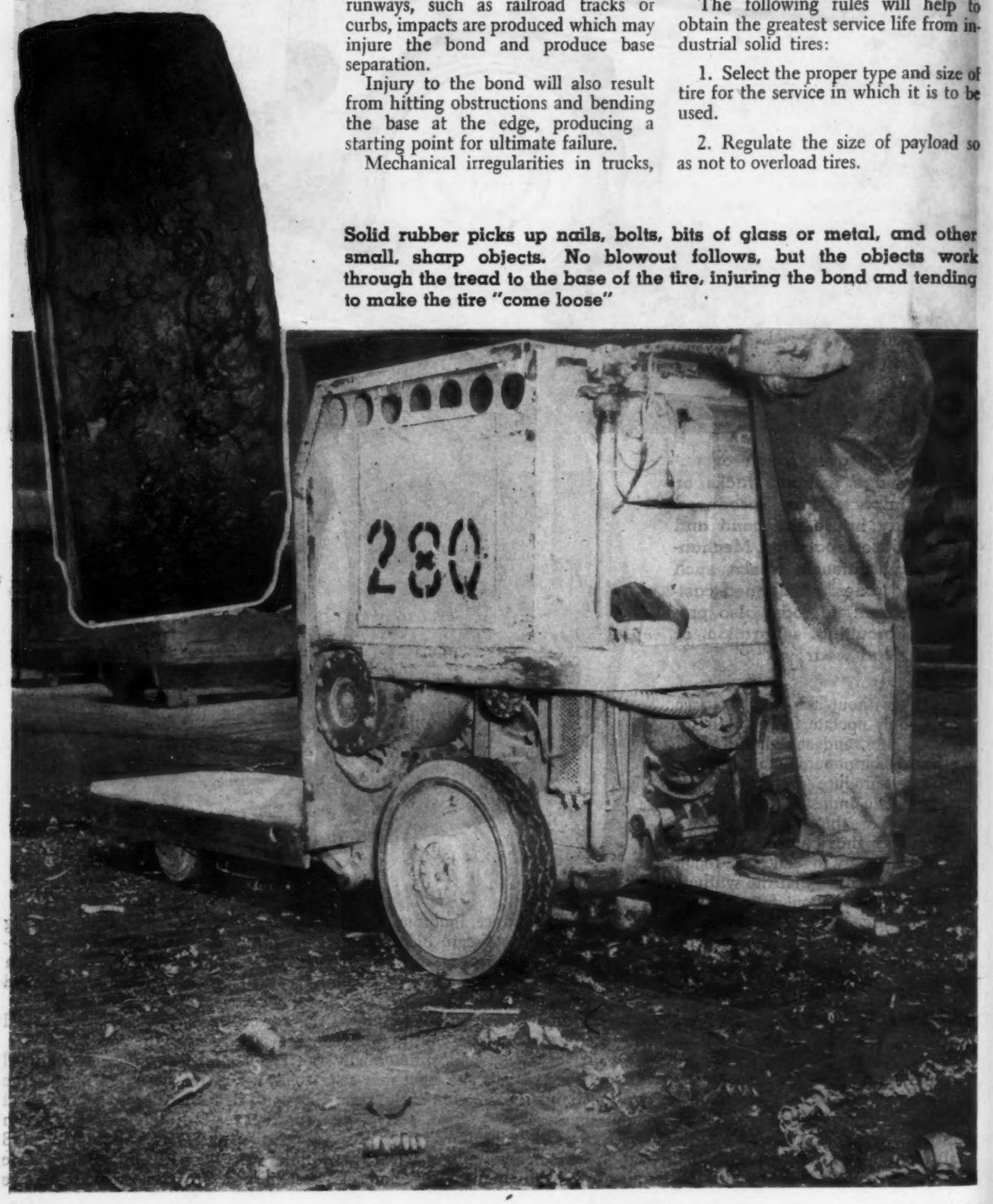
Mechanical irregularities in trucks, such as sprung axles, misaligned casters, and bent tie rods, will cause more load to be imposed on one side of the tire, producing undercutting, separation, or uneven tread wear.

Sharp turns and quick starts and stops will wear the tread rapidly and throw strains on the tire that may result in failure, or aggravate failures already started by some other cause.

The following rules will help to obtain the greatest service life from industrial solid tires:

1. Select the proper type and size of tire for the service in which it is to be used.

2. Regulate the size of payload so as not to overload tires.



Solid rubber picks up nails, bolts, bits of glass or metal, and other small, sharp objects. No blowout follows, but the objects work through the tread to the base of the tire, injuring the bond and tending to make the tire "come loose"

Sharp turns, quick starts, and short stops cause strains and rapid wear on solid rubber tires

Parking in oil or grease is just as damaging to solid rubber as it is to any other kind of tire

3. Center the payload on the truck to equalize the load on tires.

4. Avoid sharp turns and quick starts and stops.

5. Keep runways clean and exercise caution to avoid running over sharp articles.

6. Avoid running tires over, or parking truck in, oil or grease.

7. In picking up loaded skids or pallets see that operators are careful to run platform or fork of truck completely under the load in order to distribute the tire load over all wheels.

8. Check steering and axle alignment for mechanical irregularities.

9. Eliminate contact with hot metal or operating for long periods in hot oven rooms.

10. Do not operate trucks at speeds over 8 miles per hour.

11. Avoid striking obstructions with sidewall or steel base of tires.

12. Do not leave loaded vehicle standing idle for long periods of time.

13. Lubricate all moving parts properly, particularly the power and braking systems.

14. Be sure there is proper frame and platform clearance for tires.

15. Make regular inspections of tires, remove embedded objects, and cut off pieces of torn tread.

16. Exercise care when pressing tires onto wheel to be sure tire is centered and started evenly.

When and How to Switch Capacitors Automatically

W. H. CUTTINO, Capacitor Engineer, Westinghouse Electric Corporation, East Pittsburgh

AS MORE AND MORE CAPACITORS are added to an industrial distribution system with widely varying loads, a situation is reached where their effect becomes objectionable during certain operating conditions. It is, therefore, desirable to obtain the benefits of additional capacitor correction without the objectionable features. The maximum benefits are obtained by switching the correct size of capacitor at the proper time.

Capacitors may be applied at different points on a radial distribution system, as illustrated in Figure 1. In general, they should be applied as near the load as possible. If it is found desirable to switch capacitors with variations in load, give consideration first to their connection directly to the motor terminals, since they can then be switched off and on with the motor, without additional switching equipment. The size of the capacitor switched with the motor must be selected to avoid excessive overvoltages due to self-excitation. The positive way to check for overvoltage is to measure with a voltmeter the terminal voltage developed. In cases where objectionable overvoltages are encountered, use a separate switch, whose opening and closing are initiated by the motor control.

If the motors are relatively small, or if only a certain portion of the total number are expected to be connected at one time, it is usually more economical to locate the capacitors at the load centers designated C in Figure 1, and switch them automatically by additional switching equipment.

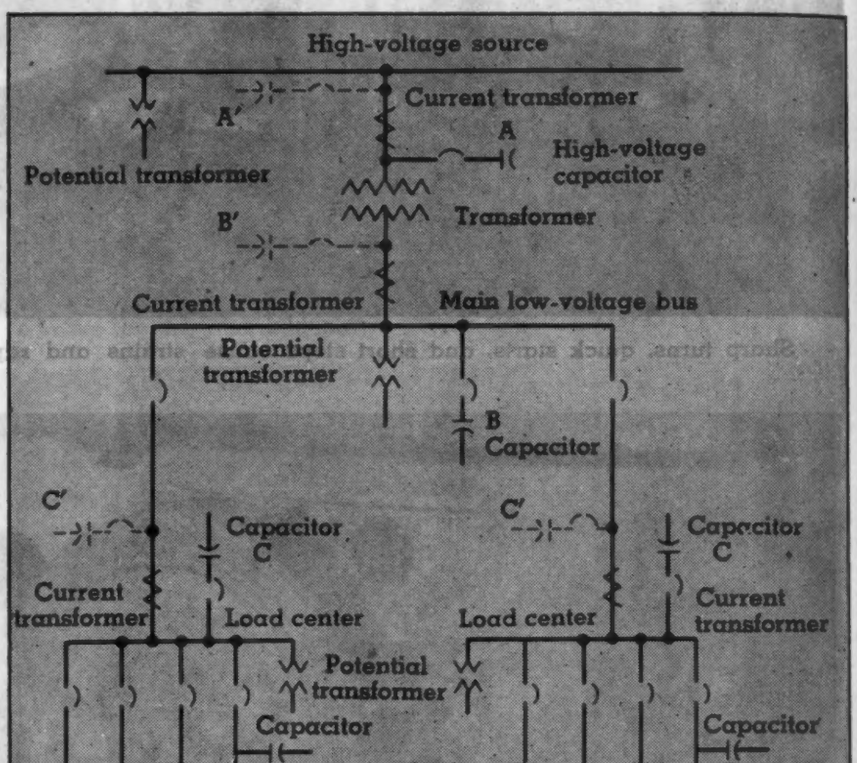


Figure 1. Single-line diagram of industrial plant distribution system, showing possible location of capacitors for power factor improvement

When Loading Varies

In some instances the plant loading is expected to vary widely, and to shift from one load center to another. Then it is usually more economical and preferable to locate the capacitors at the low-voltage bus and switch them as required. Unless there is poor regulation or excessive heating of the transformer caused by high current, it makes little difference whether point *A* or *B* is chosen. If the secondary voltage is 230 volts, the higher-voltage installation at *A* is usually more economical.

The space available for a capacitor installation is often a determining factor in selecting the location. Remember that the greatest benefits from the capacitors occur when they are connected near the load requiring the wattless current. They will reduce the current and losses all along the supply feeders and also improve the voltage regulation.

If the voltage at the plant bus and load centers is relatively high during full-load operating conditions, because of the power system operating near the upper limit, and it is desirable to have capacitors connected in order to take advantage of the lower power billing and losses, it is usually preferable to locate the capacitors at point *A* in order to keep the voltage rise produced by them to a minimum.

Capacitors are switched to prevent overvoltage, improve voltage regulation, reduce line current and losses, keep the demand low in proportion to the kilowatt loading, avoid objectionable harmonics at light load, or keep the power factor within given limits to obtain minimum cost of power purchased under certain rate schedules.

The question of whether the capacitors should be automatically switched can be answered only after proper consideration has been given to the size of capacitor, the extent to which the kilovar and kilowatt loads vary over

a typical load period, the variation of voltage with load, and the benefits of improved performance and reduced costs. In arriving at the answer, it is preferable to make measurements of kilowatts, kilovars, and voltage over a typical load period to determine the capacitor kilovars needed, and then, if automatic switching is indicated, to determine the type of control that would be best suited for actuating the switching devices.

Automatic Switching

If it is not practicable to switch the capacitors with the motors or load switches, and if manual switching is not convenient or reliable, capacitors should be switched automatically in order to control the amount of capacitor kilovars connected. The three generally accepted methods of switching capacitors automatically are: (1) Voltage control; (2) current control, and (3) kilovar control.

If the principal reason for switching the capacitors is to avoid overvoltages on the lamps and other equipment during light-load periods, this requirement usually can be met by a single-step voltage control that disconnects the capacitor when the voltage rises above a certain value and reconnects it when the voltage falls below a predetermined level, as illustrated in Figure 2.

In a few cases it has been found desirable to switch capacitors off during light-load conditions because of the combination of objectionable harmonics and overvoltages. These cases are rare, but when they are encountered the most economical and satisfactory solution is usually the relocation of the capacitors or automatic switching to remove them during light-load conditions.

The single-step voltage control, which causes the capacitors to be disconnected during light-load conditions when the voltage rises and reconnects them as the load increases and the voltage drops, will usually give satisfactory results.

Single-step voltage control is especially useful in an industrial plant where a number of induction motors or other types of reactive load are switched off during lunch periods or at night. As the motors are shut down and the voltage rises, the control acts to remove the capacitors and avoid overvoltage. As the motors are started up again and the voltage drops, the capacitors are added to keep the voltage from falling below normal.

If voltage regulation is one of the primary objectives of the variable capacitor installation, a multi-step volt-

A 60-kvar., three-phase, 460-volt capacitor with enclosed contactor and separately mounted switching control, improves voltage conditions and power factor in a large industrial plant

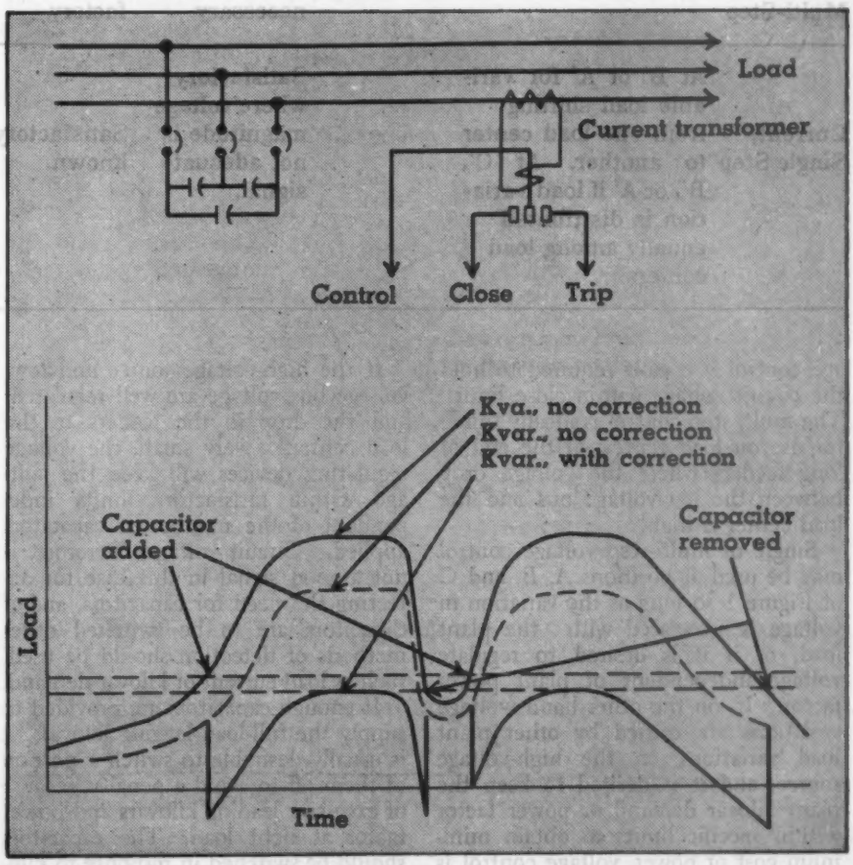


Figure 2. Schematic diagram for single-step current control, with plant load pattern illustrating the switching of capacitors by load current

Application of Automatic Capacitor Switching Control

Type of Control	Location of Capacitors (See Figure 1 for letter references)	Regulating Voltage	Removal of Capacitors at Light Load	Switching Capacitors for Minimum Power Billing			
				Power Factor for Billing Determined by			
				Measurement of Power Factor	Kw.-hr. and Kvar.-hr. Comparison	Billing on Kw. and Kvar. Demand	Billing on Kvar. Demand
Voltage, Single Step	At B or A for variable loads shifting from one load center to another		Satisfactory	Satisfactory if voltage signal is always a function of plant loading.			
Voltage, Multi-Step	At C, B, or A if load variation is distributed equally among load centers	Satisfactory	Usually not necessary				
Kvar., Single Step	At C, B, and A		Satisfactory where voltage magnitude or load current is not adequate signal	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Kvar., Multi-Step	At C, B, and A		Usually not necessary	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Current, Single Step	At B′ or A′ for variable load shifting from one load center to another. At C′, B′, or A′ if load variation is distributed equally among load centers		Satisfactory where voltage magnitude is not adequate signal.	Satisfactory if power factor and kw. loading are known.			

age control is usually required to hold the circuit voltage within close limits. The multi-step control is ideally suited for use on load centers at the end of long feeders where the voltage drop between the low-voltage bus and the load center is high.

Single or multi-step voltage control may be used at positions *A*, *B*, and *C* of Figure 1 so long as the variation in voltage is associated with the plant load, or if it is desired to regulate voltage independent of plant power factor. If, on the other hand, voltage variations are caused by other plant load variations on the high-voltage source, and it is desired to keep the plant kilovar demand or power factor within specific limits to obtain minimum cost of power, voltage control is not suitable and other methods of automatic control must be considered.

If the high-voltage source and low-voltage bus voltage are well regulated, and the drop in the feeders to the load centers is very small, the voltage regulating devices will keep the voltage within satisfactory limits independent of the number of capacitors applied. Circuit voltage, therefore, is not a good signal in this case for detecting the need for capacitors, and if capacitors are to be switched other methods of detection should be used, such as load current or kilovar demand.

If enough capacitors are provided to supply the full-load lagging kilovars, it is usually desirable to switch a portion of them off to avoid a penalty because of excessive leading kilovars and power factor at light load. The capacitors should be switched in response to kilovar or current control if the voltage is well regulated or if it varies due to changes in loads at other plants on the high-voltage distribution circuits.

The choice between current and kilovar control depends upon the relationship of the load power factor to variations in kilowatt loading and the physical circuit arrangement. Current control is simpler and less expensive than the other and is usually used where the power factor remains substantially constant with variations in kilowatt loading and where the circuit voltage is well regulated. This type of control receives the signal from a current transformer located on the load side of the capacitor to measure the uncorrected load current, and in this case the capacitors would be located at points *A′*, *B′* and *C′* of Figure 1.

On the other hand, the current transformer for signaling the current element of the kilovar relay is usually

located on the supply side of the capacitors, which would then be located at *A*, *B*, and *C*. In cases where either type of control can be used, the physical circuit arrangement and the availability and location of instrument transformers may dictate the type of control to be selected.

The current control shown in Figure 2 is especially useful in a plant where the load consists mainly of induction motors, a number of which are switched off at lunch periods and at night, and where voltage regulation is good, or the voltage variation is not associated with variations in the plant load. As the motors are shut down, the current drops and the current control disconnects the capacitor to prevent excessive leading power factor. As the motors are started up again, the process is reversed and the capacitor is connected to prevent excessive lagging power factor.

The kilovar control illustrated in Figure 3 is usually used where the circuit voltage is well regulated and the load power factor varies in an unpredictable manner with variations in kilowatt loading. It is also used if voltage variations occur because of other plant load variations and it is desired to keep the kilovar demand or power factor within set limits. The current element of the kilovar relay receives its signal from a current transformer located on the supply side of the capacitor. The voltage element can receive its signal from a potential transformer located on either side of the capacitor. It is, therefore, obvious that the capacitors must be located at points *A*, *B*, and *C* of Figure 1.

When Kilovars Control

Kilovar control gives the best results for a plant fed from a well-regulated bus where the plant load consists of both induction and synchronous motors that are started and stopped independently of one another. As the motors are started up, the kilovar control measures the kilovar demand and connects capacitors to keep the lagging kilovars and power factor from exceeding the desired limits. As the motors are switched off, the control disconnects capacitors to keep the leading kilovars and power factor down.

The application of voltage, current, and kilovar control is summarized in the table.

For a clear picture of voltage regulation, it is helpful to remember that for practical purposes the voltage drop can be determined from the kilowatt load component flowing through the resistance of the circuit plus the kilovar component flowing through the reactance of the circuit. The voltage drop caused by the kilowatts is the product of the kilowatt load in amperes and the circuit resistance in ohms. The voltage drop caused by the kilovars is the product of the kilovar load in amperes and the circuit reactance in ohms. The total voltage drop is the sum of the two.

For example, a load current of 141 amp. at 70.7 percent power factor is made up of 100 amp. in phase and 100 amp. out of phase. If the resistance and reactance ohms of the circuit to the load are 0.01 and 0.05 ohms respectively, the voltage drop due to kilowatts will be 1 volt and the drop due to kilovars will be 5 volts, or a total drop of 6 volts.

The voltage rise produced by the capacitors is the product of the circuit reactance ohms and the change in kilovar load amperes provided by the capacitor. Therefore, if a 100-amp. capacitor were added, the voltage rise would be 5 volts and the over-all drop would then be only 1 volt.

When calculating the voltage rise produced by the capacitor above an existing voltage level, the non-linear variation of exciting kilovars drawn by motors, transformers, and other equipment should be given consideration. If the voltage level is high, the exciting kilovars may increase rapidly with a small increase in voltage and should be taken into account in arriving at the net kilovars. It is also to be kept in mind that the capacitor kilovars vary as the square of the voltage for a given rating. If the voltage level is moderate and steps are taken to permit only a

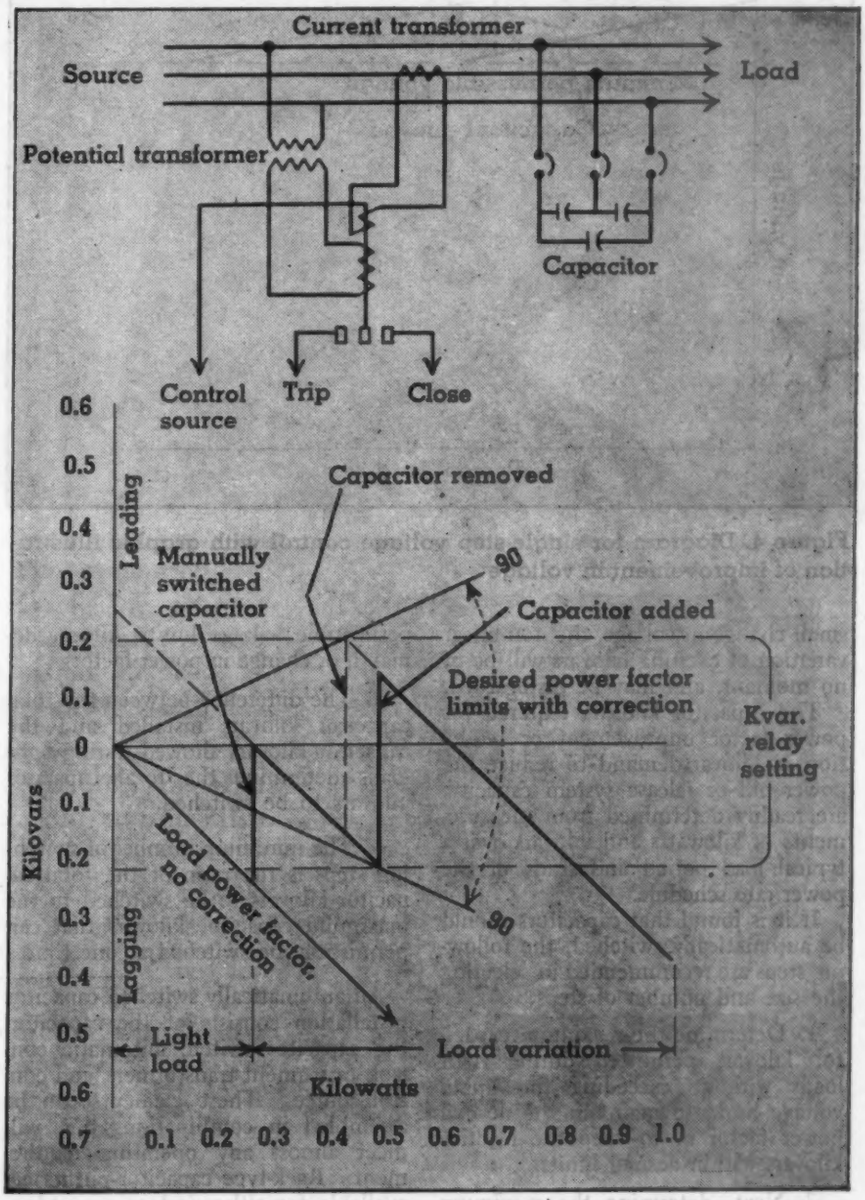


Figure 3. Simplified diagram for single-step kvar. control and illustration of how kvar. regulation keeps power factor within desired limits

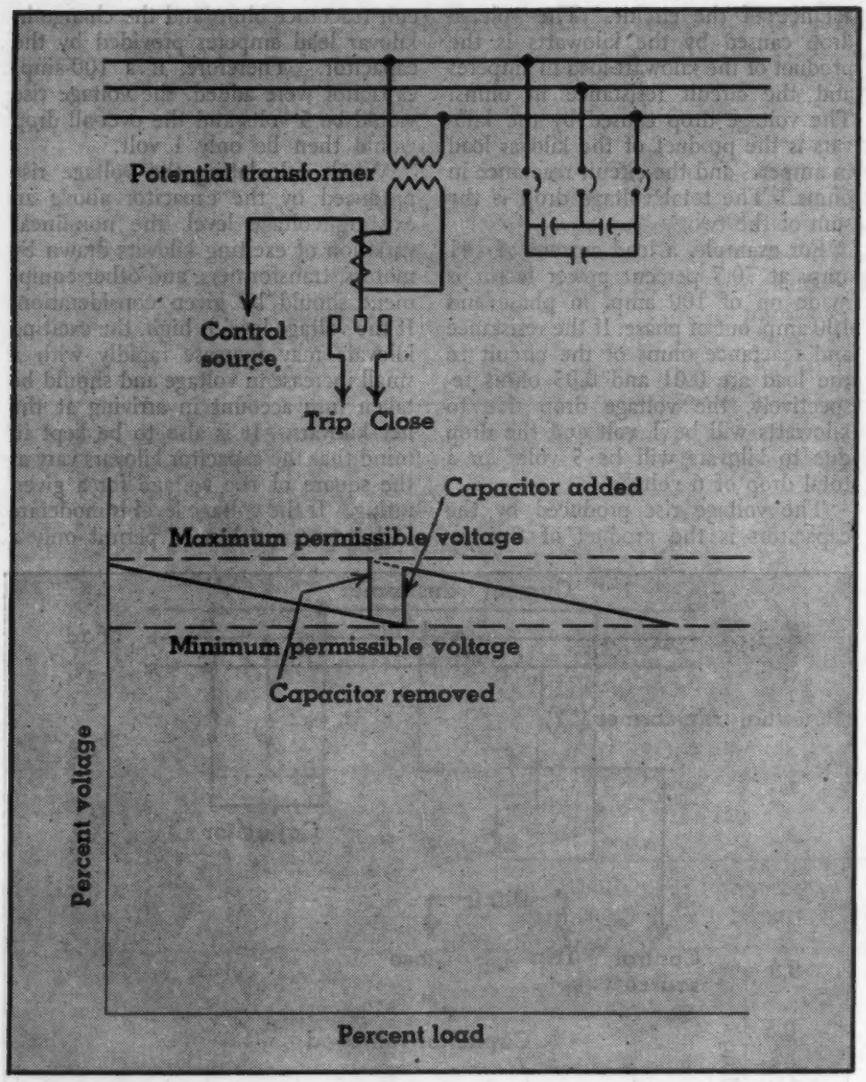


Figure 4. Diagram for single-step voltage control with graphic illustration of improvement in voltage

small change in voltage, the non-linear variation of exciting kilovars will be of no moment, and may be disregarded.

The capacitor kilovars required for power factor improvement or reduction in kilovar demand to reduce the power bill or release system capacity, are readily determined from measurements of kilowatts and kilovars over a typical load period and study of the power rate schedule.

If it is found that capacitors should be automatically switched, the following steps are recommended in selecting the size and number of steps:

1. Determine the maximum capacitor kilovars permitted during light loads without exceeding the upper voltage limit, to maintain the desired power factor or to keep the reactive kilovars within desired limits.

2. Next, determine the maximum capacitor kilovars that can be switched at one time without exceeding the permissible voltage limits, kilovar demand, or change in power factor.

3. The difference between the total capacitor kilovars installed and the capacitor kilovars allowed during light loads determine the total capacitor kilovars to be switched.

4. The minimum number of switching steps is the ratio of the total capacitor kilovars to be switched to the maximum capacitor kilovars that can permissibly be switched at one time.

An automatically switched capacitor installation consists of the capacitor, the capacitor switch, automatic control, instrument transformers, and control source. These elements can be assembled in combinations that will meet almost any operating requirement. Rack-type capacitor outfits are available for either indoor or outdoor service. The capacitor switch and the automatic control can be assembled in the capacitor rack or the switch and control can be mounted separately. If it is desirable to have the control elements at some central location, the automatic control assembled in a cabinet can be mounted separately from the capacitor or capacitor switch. This latter arrangement is often used with indoor multiple-unit, dust-tight capacitors located at the load centers, with the control located near the high-voltage source or main low-voltage bus.

Electrically operated circuit breakers are generally used for switching the larger capacitors. They have the advantage of providing overcurrent or fault current protection in addition to the switching function. Capacitors in some installations may be switched as many as 20 or 25 times per day.

Switching Small Units

Industrial contactors are used for small capacitors, particularly where several capacitors located at different load centers are to be switched simultaneously. This scheme is on the basis that the fault current or momentary inrush current does not exceed the maximum rating of the contactor.

The automatic control that receives and interprets the signal and acts to perform the required function consists of a master relay, time delays, auxiliary devices, and control switch. The master element is a voltage-sensitive relay, a current-sensitive relay, or a kilovar-sensitive relay. It receives and interprets the signal and initiates the switching operation after a time delay to prevent unnecessary switching operations caused by momentary disturbances on the power circuit. The auxiliary relays respond to the signal of the master element plus the time-delay relay to open or close the capacitor switch and relieve the sensitive control relays of handling the heavier control currents.

A voltage-sensitive relay for voltage control, illustrated in Figure 4, receives its signal from a potential transformer located at either side of the capacitor location at the point where the voltage is to be controlled.

The current control receives its signal from a current transformer located on the load side of the capacitor, as Figure 2 shows.

A kilovar relay responds to the combination of voltage and corrected load current. The current element of the master relay receives its signal from a current transformer located on the supply side of the capacitor, as in Figure 3. The potential transformer for energizing the voltage element can be located on either side of the capacitor.

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Building Materials

Building materials introduced to you by *Factory* during the past 12 months are reviewed here to give you a quick one-year summary

CEMENT—Furane-base resin cement, called Duracite, is said to be resistant to inorganic as well as organic acids, alkalis, oils, and solvents, and to be of high compressive and tensile strength. U. S. Stoneware Company, Akron.

FLAME-PROOF PAINT—Metallic flame-proof paint, known as Blaze-Pruf Silver-Lume, with rust preventive for extremely hot surfaces, is claimed to stand up to 1800 deg. F. The Wilbur & Williams Company, Boston.

FLOOR BRICK—"Emri-Tread" floor brick is claimed to provide safe footing where wet or greasy materials on floors are unavoidable. Grease or oil can be flushed and brushed off without affecting non-slip quality. Empire Emery Corporation, New York.

FLOOR COVERING—Pabco Sani-Grip is a mastic floor covering for steel, galvanized iron, suspended concrete, or interior unpainted wooden surfaces, adapted to exterior and interior exposure. Said to resist salt water, gasoline, lubricating oil, grease, and fats, and to have germicidal tendencies. The Paraffine Companys, Inc., St. Francisco. (Figure 1)

FLOOR MATERIAL—known as Stonoleum, can be laid over old concrete, cement, wood, or composition without adhesives or separate bonding agents. Can also be used as patching material. Continental Asbestos Refining Corporation, New York.

FLOOR SURFACE MATERIAL—When used in place of sand and gravel or stone as component in floor topping mixture, with cement and water, material called Ferem is claimed to make a surface coat with great compressive and tensile strength. A. C. Horn Company, Long Island City.

GROUTING AND PATCHING—Compound, known as Ferrolith G, is used in concrete grouting and patching, repointing mortar joints, sealing pre-cast pipe joints, and similar functions. Said to eliminate vibration and shifting of machinery, provide secure anchorage for bolts placed in concrete, and to strengthen supporting columns. L. Sonneborn Sons, Inc., New York.

HEAT-RESISTING PAINT—Triple-A paint is for protection and decoration of interior or exterior surfaces subjected to high heat. Said to withstand temperatures up to 2500 deg. F., depending upon the surface. Quigley Company, Inc., New York.

MAINTENANCE MATERIALS—Mastic Mix is a synthetic material claimed to eliminate the necessity for concrete mixers in installing as well as resurfacing floors. Maker states that it will not chip, is noiseless, resilient, and fireproof. Rubber-like synthetic plastic mastic for roofs is claimed to effect protection against the elements, and to conform to shape even if roof buckles. A liquid, known as Creto, is reported to waterproof any masonry. Certainteed Industries, Los Angeles.

MASONRY PAINT—Ready-mixed exterior paint for masonry is claimed to simplify procedure of protecting masonry surfaces exposed to weather. The Wilbur & Williams Company, Boston.

NON-SKID MATERIAL—of heavy plastic, known as Saf-T-Dek No. 700, is said to eliminate skidding and slipping on any dry, wet, or oily floor or stairway surfaces. Material is claimed to be tough, tenacious, fire-resistant, to stick to wood, steel, concrete, masonry, or glass. Truscon Laboratories, Inc., Detroit.

PANELS—of sheet metal, called Fenestra, can be used to sheath floors, walls, partitions, and roofs of buildings. Provide both framing and covering material in single unit; and some types offer insulation and soundproofing. Detroit Steel Products Company, Detroit.

PROTECTIVE COATING—Monex is a non-oxidizing plastic coating claimed to be highly resistant to salt air, brine, moisture, weathering, petroleum oils, greases, and other agents harmful to aluminum paints. Said to be applicable for interior or exterior use on any surface. Air dries or bakes to withstand temperatures —30 to 1000 deg. F. Monon Resins & Chemicals, Inc., Hammond, Ind.

PROTECTIVE COATING—called Triad PR, is for the sidewalls of both wet and dry spray booths. Facilitates scraping off paint in dry booths having no drainage facilities. Can be applied by either brush or spray gun. Detrex Corporation, Detroit.

SEEPAGE SEALER—"Seep Seal," when mixed with cement, can be inserted in cracks or holes in concrete while water is gushing through, and will stop the leak in 2 minutes, maker claims. Also can be used for dampproofing walls. Rock-Tred Corporation, Chicago.

WALL PATCH—known as Plastic Patch, is used for repairing and resurfacing damaged walls and woodwork before painting and enameling. Maker claims that it adheres firmly to plaster, wallboard, brick, metal, and all painted surfaces. Sherwin-Williams Co., Cleveland. (Figure 2)

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Contributors may submit as many items as they wish. Mail yours today!

Prize-winning short this month, "Automobile Lift Serves as Elevator" on page 158

Limit Switch Lowers Cutter Breakage

An electric-limit switch, used in conjunction with a shear pin, has considerably reduced cutter breakage on a special plunge milling operation at General Electric's Erie Works. A regular shear key was first tried in the machine, but, since the automatic cycle might not be completed, the feed would not stop with the cutter.

An electric limit switch and plunger were installed, and the steel key was replaced with a softer brass one, the length and strength of which were determined by experimentation, so that the key would fall before the cutter. When the key shears, the projecting end—which rides against a disk connected to the limit switch—falls free, releasing the switch and causing the machine to react as though the cycle were completed.

•

To Keep a Drill From Turning in Chuck

LEON N. LOEB, East McKeesport, Pa.

In using a three-jawed chuck for holding drills and taps, it sometimes happens that the tool will turn in the chuck when a heavy cut is being made. This is likely to damage both the tool and the work.

To avoid this trouble, grind a shallow flat spot on the tool, in three places equally spaced around the stem. These flats will not only keep the tool from turning, but will also permit it to be fastened in the chuck by hand, and eliminate the need for a chuck wrench. They will also prevent the marring of the drill size marker that occurs when a drill slips in the chuck, and make reading the sizes much easier.

The flattening of the stem need not be great; in fact, on a $\frac{1}{4}$-in. drill a flat $\frac{3}{64}$ inch deep and $\frac{3}{32}$ inch wide is ample.

•

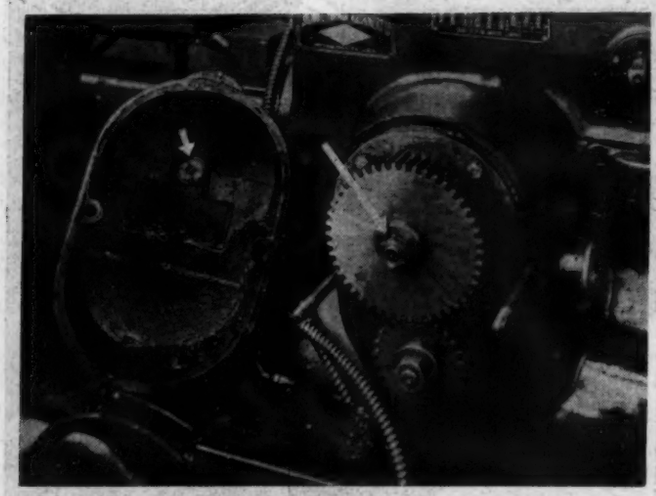
Air Pressure Operates Water Level Switch

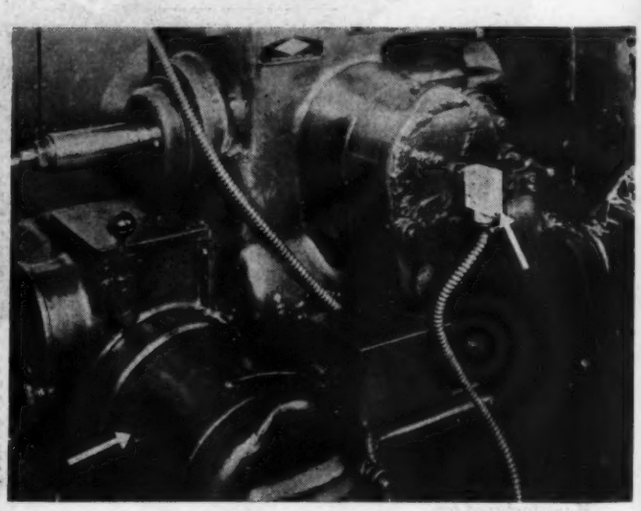
J. R. LEINBACH, Electrical Engineer, Lehigh Portland Cement Co., Allentown, Pa.

Trouble was experienced with the switch controlling the level of the water in a tank. In cold weather a float switch was unsuitable because ice prevented free movement of the float. An ordinary pressure switch installed on the pump discharge did not serve satisfactorily, because it was affected by the pressure impulses from the plunger pump.

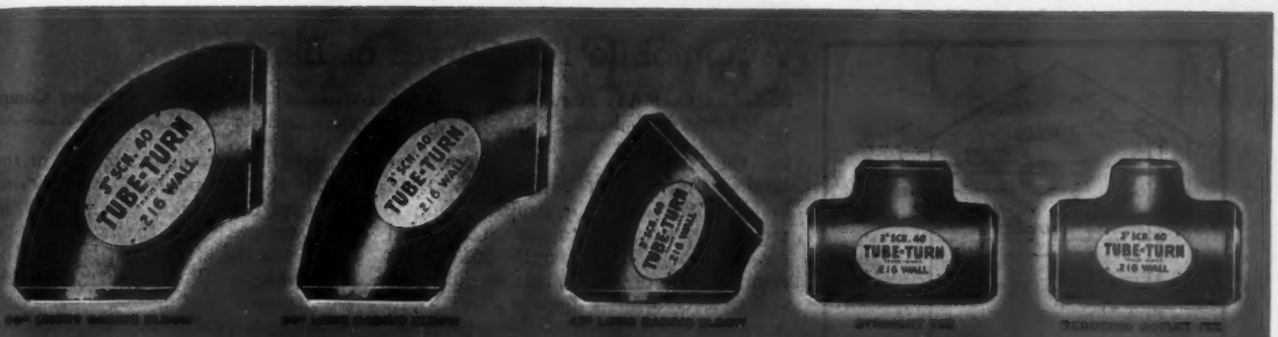
To clear up these difficulties a pressure switch of suitable range was attached to a length of 1-in. pipe and installed in the water tank, as shown in the illustration. The bottom of the pipe was left open. All joints were made air-tight.

The rise and fall of the water level produces a variable pressure of the air in





For better protection of cutters against breakage, the steel shear pin was replaced with one made of brass (left). To insure stopping of the feed, an electric limit switch (right) was installed



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WELDING FITTINGS AND FLANGES

TUBE-TURN WELDING FITTINGS—RANGE OF SIZES

Type of Fitting	Description	Standard Weight	Extra Strong	Schedule 160	Double Extra Strong	Light Gauge	
						Nominal Pipe Size	Iron Pipe Size
Elbows	90° Long Radius	½"-24"	¾"-24"	1"-12"	1"-8"	4"-24"	3"-12"
Elbows	90° Short Radius	1"-30"	1½"-30"				
Elbows	45° Long Radius	½"-30"*	¾"-30"*	1"-12"	1"-8"	4"-24"	3"-12"
Returns	180° Long Radius	½"-24"	1"-24"	1"-12"	3"-8"	4"-24"	3"-12"
Returns	180° Short Radius	1"-30"	1½"-30"				
Returns	180° Extra Long Radius	1"-2½"	1"-2½"				
Tees	Straight	¾"-24"	¾"-24"	1"-12"	1"-8"		
Tees	Reducing Outlet	¾"-24"	¾"-24"	¾"-12"	1"-8"		
Reducers	Concentric & Eccentric	1x⅜-24x20	1x⅜-24x20		1x¾-12x10		
Caps		1"-24"	1"-24"		1"-8"		
Stub Ends	Lap Joint	1"-24"	1"-24"				
Nipples	Shaped, 90° to Header	1¼"-12"	1¼"-12"				
Nipples	Shaped, 45° to Header	1¼"-12"	1¼"-12"				
Saddles		2"-24"**					
Laterals	Straight	1¼"-24"	1¼"-24"				
Laterals	Reducing-on-Run	1¼"-24"	1¼"-24"				
Crosses	Straight	¾"-24"	¾"-24"				
Rings	Welding	¾"-12"	¾"-12"				
Sleeves	Welding	2"-24"**					

SUPER Tube-Turn 45° long radius elbows, 90° long radius elbows, and 180° long radius returns available in both Standard weight and Extra Strong in sizes from 3" to 12". Tube-Turn welding fittings and flanges conform to applicable ASA and ASTM Standards. For further details please refer to Tube Turns catalog and data book No. 111.

*30" size short radius.

**Since saddles and sleeves are used for external reinforcement only, they do not conform to iron pipe size thicknesses.

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Welding Neck	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Slip-On	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Lap Joint	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Threaded	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Blind	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Socket Type	¼"-24"	¼"- 4"		¼"-3½"			
Reducing-threaded or slip-on	¾"-24"	¾"-24"	¾"-24"†	¾"-24"	¾"-24"*	¾"-24"	¾"-12"
Orifice—threaded		1"-24"	4"-12"	4"-12"	3"-12"	1"-12"	
Orifice—slip-on		1"-24"					
Orifice—welding neck		1"-24"	4"-12"	1"-12"	3"-12"	1"-12"	
Long Welding Neck	1"-24"	1"-24"	1"-10"	1"-10"	1"-10"	1"-10"	

†Dimensions on sizes thru 3½" same as for 600 lb. flanges.
*Dimensions on sizes thru 2½" same as for 1500 lb. flanges.

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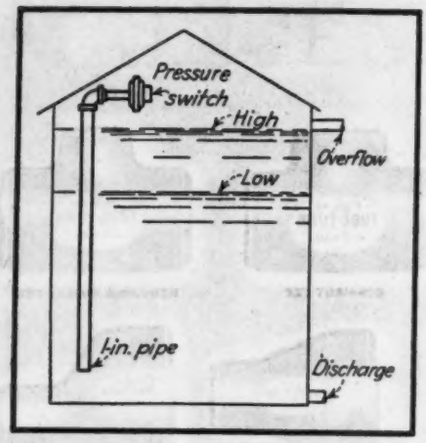

the upper part of the pipe, which is proportional to the level. Hence it was a simple matter to set the switch to start and stop the pump motor at the desired low and high levels of the water.

•

Degreasing Saves Spun Glass Filters

I. W. HUNGERFORD, Plant Engineer, Connecticut Telephone & Electric Division, Great American Industries, Inc., Meriden, Conn.

The conservation of critical materials and labor is one of the results of the semi-monthly cleaning program for spun glass filters in our plant.

These filters do not last too long, and it used to be necessary to discard them. Now we have adopted the practice of putting them through the degreaser, which brings them back to 100 percent efficiency. Then we spray them with a light oil to make the dust in the air adhere to the spun glass.

•

Access Door Permits Fan Runner Cleaning

B. A. PARKS, Maintenance Engineer, Crane Company, Chicago

Centrifugal-type exhaust fans, used in connection with dust collecting systems, sometimes give trouble because dust and dirt adhere to the runner and to the interior of the casing. If the solid material accumulates to any appreciable thickness, a marked decrease in fan capacity results, and there is increased wear and tear on the entire mechanism, because the runner is likely to be thrown out of balance.

To permit periodic inspection and cleaning of exhaust fans, particularly those handling air with a high content of dust or dirt, it is our practice to install a good-sized door in some accessible part of the fan casing. This door is usually installed in the scroll so that all parts of the runner may be reached. It is important, in installing access doors, that care be taken to make a tight fit, and to preserve as closely as possible the smooth surface on the interior of the fan casing.

Automobile Lift Serves as Elevator

HERBERT O. MAY, Plant Engineer; Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J.

In the transport of material carried in floor trucks from building No. 8 to building No. 29 of the Ampere plant, it was always necessary to use an overhead traveling crane to transfer the load up or down because of an unavoidable difference in floor levels of these shops of about 5 feet. A vertical drop, protected by a guardrail, occurs where the two buildings join each other. These two buildings were constructed at different times, but no intermediate firewall exists between them at this point, and a traveling crane has been built to run between the two buildings. A railed stairway alongside one wall provides for employee passageway.

This method of truck transport usually involved inconvenience and delay while waiting for crane service. Ordinarily, a ramp would be used for trucking between different levels of this kind. In this instance, however, a ramp was not feasible because the length of ramp required for a suitable grade would consume valuable manufacturing space.

The problem was solved by the installation of an ordinary hydraulic automobile lift hoist of 2-ton capacity to operate between the two floor levels. This hoist was purchased second-hand from a neighborhood gasoline station that had discontinued business. As shown in the photograph, the hoist was converted to plant usage by adding a solid sheet-steel platform of about 5x8 feet. A pit on the lower floor of about 8 inches deep was built so that the platform could be lowered even with the floor. The pneumatic control valve was placed at the upper level. Control was arranged for automatic stopping of the lift exactly at the upper level, a regulation that could be obtained in this type of lift.

It was necessary to incorporate other features in the lift to meet legal and safety requirements. For instance, a toeboard was required around the three sides not bordering the wall. To eliminate a bothersome problem of a removable toeboard at the take-off end, a pivoted sheet-steel plate was designed with counterweights that hold the toeboard in a vertical plane all the while the platform is above the lower floor. As the platform descends to the floor, however, the counterweights are automatically pushed upwards as they strike the floor, thereby revolving the plate about its pivots to a horizontal plane, and making it serve as a floor plate over the slight opening between the platform and floor.

Guardrails were placed on the sides of the platform, and a removable guard chain was installed at the open end of the platform. At the top entrance to the lift an iron-frame gate supported on casters was installed, which can be manually opened or shut by rolling it lengthwise. The sides of the lift were fenced in with wire-screen caging extending from the lower floor level to the upper, and the front open side of the lift was protected by an expanding gate permanently attached at its ends to the lower floor and the lift platform, to keep anyone from getting caught underneath the lift.

The lift operates evenly and smoothly, and can change to either level in 15 seconds. The total cost of its installation was about $225.

Hydraulic automobile lift hoist is used at Crocker-Wheeler to handle trucks between buildings whose floor levels vary about 5 feet

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Circumference and Area of Circles

IN THE TABLE BELOW and on page 162 are given the circumference and area of circles for diameters beginning at 1 inch, with increments of 1 inch, up to a diameter of 200 inches. These data are calculated from the formulas for circumference and area of a circle, when given the diameter. These formulas are:

Circumference = Diameter × 3.1416, and Area = square of diameter × 0.7854.

Diameter		Circumference			Area	
Inches	Feet and Inches	Inches	Feet and Inches	Feet in Decimals	Square Inches	Square Feet
1	0.0833	3.1416	0′ 3 1/8″	0.2618	0.7854	0.0055
2	0.1667	6.283	0′ 6 2/16″	0.5236	3.142	0.0218
3	0.2500	9.425	0′ 9 7/16″	0.7854	7.068	0.0491
4	0.3333	12.57	1′ 0 9/16″	1.047	12.57	0.0873
5	0.4167	15.71	1′ 3 11/16″	1.309	19.64	0.1364
6	0.5000	18.85	1′ 6 7/8″	1.571	28.27	0.1963
7	0.5833	21.99	1′ 10 ″	1.833	38.49	0.2673
8	0.6667	25.13	2′ 1 1/8″	2.094	50.27	0.3491
9	0.7500	28.27	2′ 4 1/4″	2.356	63.62	0.4418
10	0.8333	31.42	2′ 7 7/16″	2.618	78.54	0.5454
11	0.9167	34.56	2′ 10 9/16″	2.880	95.03	0.6600
12	1.000	37.70	3′ 1 3/4″	3.142	113.1	0.7854
13	1′ 1″	40.84	3′ 4 7/8″	3.403	132.7	0.9218
14	1′ 2″	43.98	3′ 8 ″	3.665	153.9	1.069
15	1′ 3″	47.12	3′ 11 1/8″	3.927	176.7	1.227
16	1′ 4″	50.27	4′ 2 1/4″	4.189	201.1	1.396
17	1′ 5″	53.41	4′ 5 3/8″	4.451	227.0	1.576
18	1′ 6″	56.55	4′ 8 1/2″	4.712	254.5	1.767
19	1′ 7″	59.69	4′ 11 5/8″	4.974	283.5	1.969
20	1′ 8″	62.83	5′ 2 7/8″	5.236	314.2	2.182
21	1′ 9″	65.97	5′ 6 ″	5.498	346.4	2.405
22	1′ 10″	69.12	5′ 9 1/8″	5.760	380.1	2.640
23	1′ 11″	72.26	6′ 0 1/4″	6.021	415.5	2.895
24	2′ 0″	75.40	6′ 3 3/8″	6.283	452.4	3.142
25	2′ 1″	78.54	6′ 6 1/2″	6.545	490.9	3.409
26	2′ 2″	81.68	6′ 9 5/8″	6.807	530.9	3.687
27	2′ 3″	84.82	7′ 0 3/4″	7.069	572.6	3.976
28	2′ 4″	87.96	7′ 4 ″	7.330	615.8	4.276
29	2′ 5″	91.11	7′ 7 1/8″	7.592	660.5	4.587
30	2′ 6″	94.25	7′ 10 1/4″	7.854	706.9	4.909
31	2′ 7″	97.39	8′ 1 3/8″	8.116	754.8	5.241
32	2′ 8″	100.5	8′ 4 1/2″	8.378	804.3	5.585
33	2′ 9″	103.7	8′ 7 5/8″	8.639	855.3	5.940
34	2′ 10″	106.8	8′ 10 3/4″	8.901	907.9	6.305
35	2′ 11″	110.0	9′ 2 ″	9.163	962.1	6.681
36	3′ 0″	113.1	9′ 5 1/8″	9.425	1017.9	7.069
37	3′ 1″	116.2	9′ 8 1/4″	9.687	1075.2	7.467
38	3′ 2″	119.4	9′ 11 3/8″	9.948	1134.1	7.876
39	3′ 3″	122.5	10′ 2 1/2″	10.21	1194.6	8.296
40	3′ 4″	125.7	10′ 5 5/8″	10.47	1256.6	8.727
41	3′ 5″	128.8	10′ 8 3/4″	10.73	1320.3	9.168
42	3′ 6″	131.9	10′ 11 7/8″	11.00	1385.4	9.621
43	3′ 7″	135.1	11′ 3 1/8″	11.26	1452.2	10.08
44	3′ 8″	138.2	11′ 6 1/4″	11.52	1520.5	10.56
45	3′ 9″	141.4	11′ 9 3/8″	11.78	1590.4	11.04
46	3′ 10″	144.5	12′ 0 1/2″	12.04	1661.9	11.54
47	3′ 11″	147.7	12′ 3 5/8″	12.30	1734.9	12.05
48	4′ 0″	150.8	12′ 6 3/4″	12.57	1809.6	12.57
49	4′ 1″	153.9	12′ 9 7/8″	12.83	1885.7	13.10
50	4′ 2″	157.1	13′ 1 1/8″	13.09	1963.5	13.64
51	4′ 3″	160.2	13′ 4 1/4″	13.35	2042.8	14.19
52	4′ 4″	163.4	13′ 7 3/8″	13.61	2123.7	14.75
53	4′ 5″	166.5	13′ 10 1/2″	13.88	2206.2	15.32
54	4′ 6″	169.6	14′ 1 5/8″	14.14	2290.2	15.90
55	4′ 7″	172.8	14′ 4 3/4″	14.40	2375.8	16.50
56	4′ 8″	175.9	14′ 7 7/8″	14.66	2463.0	17.10
57	4′ 9″	179.1	14′ 11 ″	14.92	2551.8	17.72
58	4′ 10″	182.2	15′ 2 1/4″	15.18	2642.1	18.35
59	4′ 11″	185.4	15′ 5 3/8″	15.45	2734.0	18.99
60	5′ 0″	188.5	15′ 8 1/2″	15.71	2827.4	19.63
61	5′ 1″	191.6	15′ 11 5/8″	15.97	2922.5	20.29
62	5′ 2″	194.8	16′ 2 3/4″	16.23	3019.1	20.97
63	5′ 3″	197.9	16′ 5 7/8″	16.49	3117.2	21.65
64	5′ 4″	201.1	16′ 9 ″	16.76	3217.0	22.34
65	5′ 5″	204.2	17′ 0 1/4″	17.02	3318.3	23.04
66	5′ 6″	207.3	17′ 3 3/8″	17.28	3421.2	23.76
67	5′ 7″	210.5	17′ 6 1/2″	17.54	3525.7	24.48
68	5′ 8″	213.6	17′ 9 5/8″	17.80	3631.7	25.22
69	5′ 9″	216.8	18′ 0 3/4″	18.06	3739.3	25.97
70	5′ 10″	219.9	18′ 3 7/8″	18.33	3848.5	26.73
71	5′ 11″	223.1	18′ 7 ″	18.59	3959.2	27.49
72	6′ 0″	226.2	18′ 10 1/8″	18.85	4071.5	28.27
73	6′ 1″	229.3	19′ 1 3/8″	19.11	4185.4	29.07
74	6′ 2″	232.5	19′ 4 1/2″	19.37	4300.8	29.87
75	6′ 3″	235.6	19′ 7 5/8″	19.64	4417.9	30.68
76	6′ 4″	238.8	19′ 10 3/4″	19.90	4536.5	31.50
77	6′ 5″	241.9	20′ 1 7/8″	20.16	4656.6	32.34
78	6′ 6″	245.0	20′ 5 ″	20.42	4778.4	33.18
79	6′ 7″	248.2	20′ 8 1/8″	20.68	4901.7	34.04
80	6′ 8″	251.3	20′ 11 3/8″	20.94	5026.5	34.91
81	6′ 9″	254.5	21′ 2 1/2″	21.21	5153.0	35.78
82	6′ 10″	257.6	21′ 5 5/8″	21.47	5281.0	36.67
83	6′ 11″	260.8	21′ 8 3/4″	21.73	5410.6	37.57
84	7′ 0″	263.9	21′ 11 7/8″	21.99	5541.8	38.48
85	7′ 1″	267.0	22′ 3 ″	22.25	5674.5	39.41
86	7′ 2″	270.2	22′ 6 1/8″	22.51	5808.8	40.34
87	7′ 3″	273.3	22′ 9 1/4″	22.78	5944.7	41.28
88	7′ 4″	276.5	23′ 0 3/8″	23.04	6082.1	42.24
89	7′ 5″	279.1	23′ 3 5/8″	23.30	6221.1	43.20
90	7′ 6″	282.7	23′ 6 3/4″	23.56	6361.7	44.18

(Continued on page 162)

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PRECISION MEASURING INSTRUMENTS

Circumference and Area of Circles *(Continued from page 160)*

Diameter		Circumference			Area	
Inches	Feet and Inches	Inches	Feet and Inches	Feet in Decimals	Square Inches	Square Feet
91	7′ 7″	285.9	23′ 9⅞″	23.82	6503.9	45.17
92	7′ 8″	289.0	24′ 1 ″	24.09	6647.6	46.16
93	7′ 9″	292.2	24′ 4⅛″	24.35	6792.9	47.17
94	7′ 10″	295.3	24′ 7¼″	24.61	6939.8	48.19
95	7′ 11″	298.5	24′ 10⅜″	24.87	7088.2	49.22
96	8′ 0″	301.6	25′ 1⅝″	25.13	7238.2	50.27
97	8′ 1″	304.7	25′ 4¾″	25.39	7389.8	51.32
98	8′ 2″	307.9	25′ 7⅞″	25.66	7543.0	52.38
99	8′ 3″	311.0	25′ 11 ″	25.92	7697.7	53.46
100	8′ 4″	314.2	26′ 2⅛″	26.18	7854.0	54.54
101	8′ 5″	317.3	26′ 5¼″	26.44	8011.8	55.64
102	8′ 6″	320.4	26′ 8⅜″	26.70	8171.3	56.75
103	8′ 7″	323.6	26′ 11⅝″	26.97	8332.3	57.86
104	8′ 8″	326.7	27′ 2¾″	27.23	8494.9	58.99
105	8′ 9″	329.9	27′ 5⅞″	27.49	8659.0	60.13
106	8′ 10″	333.0	27′ 9 ″	27.75	8824.7	61.28
107	8′ 11″	336.2	28′ 0⅛″	28.01	8992.0	62.44
108	9′ 0″	339.3	28′ 3¼″	28.27	9160.9	63.62
109	9′ 1″	342.4	28′ 6⅜″	28.54	9331.3	64.80
110	9′ 2″	345.6	28′ 9⅝″	28.80	9503.3	66.00
111	9′ 3″	348.7	29′ 0¾″	29.06	9676.9	67.20
112	9′ 4″	351.9	29′ 3⅞″	29.32	9852.0	68.42
113	9′ 5″	355.0	29′ 7 ″	29.58	10028.7	69.64
114	9′ 6″	358.1	29′ 10⅛″	29.85	10207.0	70.88
115	9′ 7″	361.3	30′ 0¼″	30.11	10386.9	72.18
116	9′ 8″	364.4	30′ 4⅜″	30.37	10568.3	73.39
117	9′ 9″	367.6	30′ 7½″	30.63	10751.3	74.66
118	9′ 10″	370.7	30′ 10¾″	30.89	10935.9	75.94
119	9′ 11″	373.9	31′ 1⅞″	31.15	11122.0	77.24
120	10′ 0″	377.0	31′ 5 ″	31.42	11309.7	78.54
121	10′ 1″	380.1	31′ 8⅛″	31.68	11499.0	79.85
122	10′ 2″	383.3	31′ 11¼″	31.94	11689.9	81.18
123	10′ 3″	386.4	32′ 2⅜″	32.20	11882.3	82.52
124	10′ 4″	389.6	32′ 5⅝″	32.46	12076.3	83.86
125	10′ 5″	392.7	32′ 8¾″	32.72	12271.8	85.22
126	10′ 6″	395.8	32′ 11⅞″	32.99	12469.0	86.59
127	10′ 7″	399.0	33′ 3 ″	33.25	12667.7	87.97
128	10′ 8″	402.1	33′ 6⅛″	33.51	12868.0	89.36
129	10′ 9″	405.3	33′ 9¼″	33.77	13069.8	90.76
130	10′ 10″	408.4	34′ 0⅜″	34.03	13273.2	92.18
131	10′ 11″	411.6	34′ 3⅝″	34.30	13478.2	93.60
132	11′ 0″	414.7	34′ 6⅝″	34.56	13684.8	95.03
133	11′ 1″	417.8	34′ 9⅞″	34.82	13892.9	96.48
134	11′ 2″	421.0	35′ 1 ″	35.08	14102.6	97.93
135	11′ 3″	424.1	35′ 4⅛″	35.34	14313.9	99.40
136	11′ 4″	427.3	35′ 7¼″	35.60	14526.7	100.9
137	11′ 5″	430.4	35′ 10⅜″	35.87	14741.1	102.4
138	11′ 6″	433.5	36′ 1½″	36.13	14957.1	103.9
139	11′ 7″	436.7	36′ 4⅝″	36.39	15174.7	105.4
140	11′ 8″	439.8	36′ 7¾″	36.65	15393.8	106.9
141	11′ 9″	443.0	36′ 11 ″	36.91	15614.5	108.4
142	11′ 10″	446.1	37′ 2⅛″	37.18	15836.8	110.0
143	11′ 11″	449.3	37′ 5¼″	37.44	16060.6	111.5
144	12′ 0″	452.4	37′ 8⅜″	37.70	16286.0	113.1
145	12′ 1″	455.5	37′ 11½″	37.96	16513.0	114.7
146	12′ 2″	458.7	38′ 2⅝″	38.22	16741.5	116.3
147	12′ 3″	461.8	38′ 5¾″	38.48	16971.7	117.9
148	12′ 4″	465.0	38′ 9 ″	38.75	17203.4	119.5
149	12′ 5″	468.1	39′ 0⅛″	39.01	17436.6	121.1
150	12′ 6″	471.2	39′ 3¼″	39.27	17671.5	122.7
151	12′ 7″	474.4	39′ 6⅜″	39.53	17907.9	124.4
152	12′ 8″	477.5	39′ 9½″	39.79	18145.8	126.0
153	12′ 9″	480.7	40′ 0⅝″	40.06	18385.4	127.7
154	12′ 10″	483.8	40′ 3¾″	40.32	18626.5	129.4
155	12′ 11″	487.0	40′ 6⅞″	40.58	18869.2	131.0
156	13′ 0″	490.1	40′ 10⅛″	40.84	19113.4	132.7
157	13′ 1″	493.2	41′ 1¼″	41.10	19359.3	134.4
158	13′ 2″	496.4	41′ 4⅜″	41.36	19606.7	136.2
149	13′ 3″	499.5	41′ 7½″	41.63	19855.7	137.9
160	13′ 4″	502.7	41′ 10⅝″	41.89	20106.2	139.6
161	13′ 5″	505.8	42′ 1¾″	42.15	20358.3	141.4
162	13′ 6″	508.9	42′ 4⅞″	42.41	20612.0	143.1
163	13′ 7″	512.1	42′ 8⅛″	42.67	20867.2	144.9
164	13′ 8″	515.2	42′ 10¼″	42.94	21124.1	146.7
165	13′ 9″	518.4	43′ 2⅜″	43.20	21382.5	148.5
166	13′ 10″	521.5	43′ 5½″	43.46	21642.4	150.3
167	13′ 11″	524.7	43′ 8⅝″	43.72	21904.0	152.1
168	14′ 0″	527.8	43′ 11¾″	43.98	22167.1	153.9
169	14′ 1″	530.9	44′ 2⅞″	44.24	22431.8	155.8
170	14′ 2″	534.1	44′ 6 ″	44.51	22698.0	157.6
171	14′ 3″	537.2	44′ 9¼″	44.77	22965.8	159.5
172	14′ 4″	540.4	45′ 0⅜″	45.03	23235.2	161.4
173	14′ 5″	543.5	45′ 3½″	45.29	23506.2	163.2
174	14′ 6″	546.6	45′ 6⅝″	45.55	23778.7	165.1
175	14′ 7″	549.8	45′ 9¾″	45.82	24052.8	167.0
176	14′ 8″	552.9	46′ 1⅞″	46.08	24328.5	168.9
177	14′ 9″	556.1	46′ 4 ″	46.34	24605.7	170.9
178	14′ 10″	559.2	46′ 7⅛″	46.60	24884.6	172.8
179	14′ 11″	562.4	46′ 10⅜″	46.86	25164.9	174.8
180	15′ 0″	565.5	47′ 1½″	47.12	25446.9	176.7
181	15′ 1″	568.6	47′ 4⅝″	47.39	25730.4	178.7
182	15′ 2″	571.8	47′ 7¾″	47.65	26015.5	180.7
183	15′ 3″	574.9	47′ 10⅞″	47.91	26302.2	182.7
184	15′ 4″	578.1	48′ 2 ″	48.17	26590.4	184.7
185	15′ 5″	581.2	48′ 5⅛″	48.43	26880.3	186.7
186	15′ 6″	584.3	48′ 8⅜″	48.69	27171.6	188.7
187	15′ 7″	587.5	48′ 11½″	48.96	27464.6	190.7
188	15′ 8″	590.6	49′ 2⅝″	49.22	27759.1	192.8
189	15′ 9″	593.8	49′ 5¾″	49.48	28055.2	194.8
190	15′ 10″	596.9	49′ 8⅞″	49.74	28352.9	196.9
191	15′ 11″	600.0	50′ 0 ″	50.00	28652.1	199.0
192	16′ 0″	603.2	50′ 3⅛″	50.27	28952.9	201.1
193	16′ 1″	606.3	50′ 6⅜″	50.53	29255.3	203.1
194	16′ 2″	609.5	50′ 9½″	50.79	29559.2	205.3
195	16′ 3″	612.6	51′ 0⅝″	51.05	29864.8	207.4
196	16′ 4″	615.8	51′ 3¾″	51.31	30171.9	209.6
197	16′ 5″	618.9	51′ 6⅞″	51.57	30480.5	211.7
198	16′ 6″	622.0	51′ 10 ″	51.84	30790.7	213.8
199	16′ 7″	625.2	52′ 1⅛″	52.10	31102.6	216.0
200	16′ 8″	628.3	52′ 4¼″	52.36	31415.9	218.2

Top: Micromax Recorders show malt roasting temperatures in nine roasters in the Manitowoc, Wis., plant of Rahr Malting Co. Right: General view of the roasting room.

Malt Roasting Guided by Micromax Recorders

Close control of malt roasting was greatly simplified by the Rahr Malting Company when they installed Micromax Temperature Recorders on each of their 9 horizontal, gas-fired Roasters.

As the grain is churned around inside the roaster, it pours over the stocky, rod-like thermocouple which projects into the front of the roaster and is the temperature-detecting part of the Micromax equipment. The roaster operator can look across the room and read the temperature of the batch at any moment from the large Micromax dial, and the big chart gives a permanent record of each 24-hour period. While this information is equally helpful in controlling the heating of all grades of malt, operators rely heavily on their Micromax Recorders to guide them in hitting the critical temperature—exactly—in roasting dark malt.

Both thermocouple and Micromax Recorder are sturdily constructed and are not usually influenced by vibration or other manufacturing conditions. Should a thermocouple become damaged for any reason, it is replaced without affecting the calibration of the Micromax. Changes in room temperature, or moisture or corrosion of the wires have no effect on Micromax sensitivity or accuracy, nor does the distance of the instrument from the roaster make any difference—they can be as far apart as you like.

Write for Catalog N-33A, which describes Micromax Recorders and thermocouples.

Close-up of front of Jabez Burns & Sons Roaster, showing sturdy L&N Thermocouple inserted just above the charging and discharging door.

LEEDS & NORTHRUP COMPANY, 4909 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

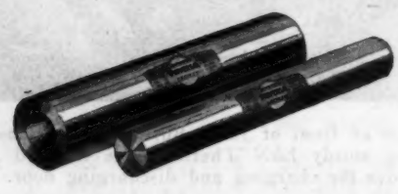
Jrl Ad N-33A-663(1)

The FIRST STEP in Reconversion Look

At Your Bearings

● It makes little difference whether your machinery and equipment has been on war duty or inactive service. Before you convert to civilian production check up on the bearings. Make sure they will stand the service expected of them. See that they are in line and free from grit or dirt. Check the lubricating system.

Breakdowns because of bearing failure can be costly. And they can be prevented. Care and attention is all they require. If replacement is necessary, specify Johnson UNIVERSAL Bronze. It's your biggest bargain in bearing bronze. Available in more than 350 sizes, solid and cored. Leading Mill Supply Distributors everywhere are ready to serve you. Write for stock list—*today*.



JOHNSON BRONZE CO.
512 S. Mill St. • New Castle, Pa.

Specify JOHNSON BRONZE

WHAT'S NEW IN EQUIPMENT

Lock Coupling

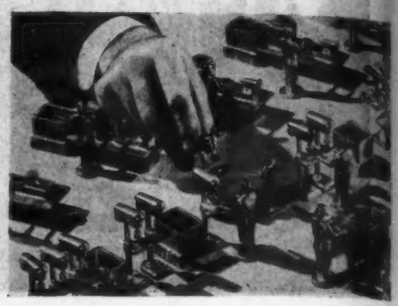
Flexible lock coupling has application in pump, compressor, and piping installations subject to vibration or settling. Said to withstand shock and vibration, permit deflection up to 5 degrees, and allow for expansion and contraction of line where temperatures and pressures are subject to wide variation. Eliminates need for threaded pipe and fittings. Can be used on portable pipelines, and is suitable for use with steam, water, air, oil, or gas, in vacuum or pressure service. Automatic Control Div., Climax Industries, 1945 South Western Ave., Chicago.

Temperature Control Devices

Elastic sleeve seal, for centrifugal, rotary, reciprocating, and other pumps using sealed rotating shafts, is announced. Can be applied on new compressors and as replacement seal for old, as well as on bent, pitted, or slotted shafts. Is said to eliminate springs, shims, and shaft glands. Oil resistant elastic material used. Seal bearing is located at the source of oil supply and is said to assure long life, because it provides proper lubrication. Simplified design, few assembly parts, and no fragile ones to break during assembly, are claimed to permit fast installation. Temperature Control Devices, New Haven 15, Conn.

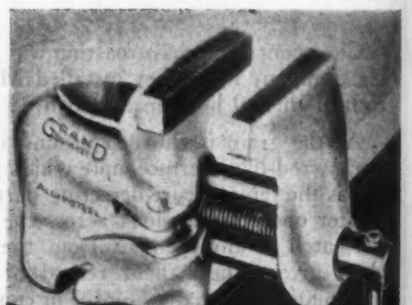
Layout Models

Designed to help engineers plan and visualize post-war reconversion, scaled models are now on the market. Stylized equipment, on a scale of ½ inch to 1 foot, can be moved about by hand to create accurate impressions of the actual layout, saving time and eliminating need for blueprint drawings. Models include lathes, drill presses, milling machines, welding, polishing, and plating equipment, punch presses, workbenches, and other equipment, trucks, toteboxes, office duplicating machines, chairs, and figures of men and women. Available in molded white metal or aluminum; special models can be made. John A. Patton, 6349 North Western Ave., Chicago 45.



Vise

Machinist's vise, known as Quickcet, is manually operated, but eliminates running in or out the screw to close or open the vise. Can be set and closed by pushing on body of the free jaw that slides in on ratchet screw and two precision guide rods, and tightens with turn of the handle. Has trigger release pawl with ¾-in. thread that holds the hardened screw under spring tension. Vise is said to open instantly to full 3 inches by pressure of thumb or finger on trigger release after tension has been eased by single turn of the loose-proof handle. Spatterproofed for welding use with copper plating on all working parts and handles, and rust-proofed. Also equipped with polished anvil on top, and with bottom screw clamp for quick shifting. Grand Specialties Co., Grand Ave. at Troy, Chicago 22.



Steel Roof Deck

Steel deck for roofs, walls, and partitions is easy to erect and maintain, neat in appearance, fireproof, and reduces insurance costs, according to maker. Furnished in lengths to take care of standard spacing of

In the making

Illustrating how ALX Cast Alloy Tool Bits are poured on a centrifugal spinner. The metal is weighed first to assure filling the mold without insufficiency or waste.

On the job

A 7/16" ALX Tool Bit rough-turning a Type 309 (25-12) stainless steel forging of 4-1/4" diameter, taking a 1/8" cut at a speed of 140 feet per minute, with a feed of .020".

Announcing ALX CAST ALLOY TOOL BITS — FAST CUTTING NON FERROUS TOOL BITS CONTAINING BORON

OUR most recent development in the field of cutting materials, ALX Cast Alloy Tool Bits, is the result of complete and thorough research investigation in the Allegheny Ludlum Laboratories, and exhaustive machining tests in the field.

Produced by advanced methods of centrifugal casting, ALX Alloy is a highly homogenous metal, with consequent advantage in cutting properties. It possesses high hardness in the as-cast condition, requiring no further heat treatment. In performance, ALX rates between carbide metal-tipped tools and high speed steel. It rounds out and completes the Allegheny Ludlum line of cutting materials—which includes Carmet carbide metals and a wide selection of high and low-tungsten and "moly" high speed steels—giving us the utmost range in supplying the tools best fitted for each individual job.

Ground and finished ALX Cast Alloy Tools, both in solid and tipped bits, are available in a complete range of sizes from our own and distributors' warehouse stocks. They fully merit serious investigation and comparative testing on your cutting jobs. The assistance of our Mill Service Staff is at your entire disposal • Also available is a new and complete bulletin on ALX Tool Bits, giving full data on selection and performance. *Write for your copy.*

Address Dept. FM-34

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

W & D...9795

ONLY A TINY STAPLE
. . . BUT VITAL

These fibre "cans" . . . protecting artillery shells . . . were sometimes stuck by the humidity in the South Pacific . . . delaying the gun crew. The container manufacturer had to have . . . immediately . . . a better method of fastening the retaining collar.

A Bostitch field specialist not only gave a definite answer to the problem quickly . . . one hand, one blow, with a Bostitch self-feeding hammer . . . but by borrowing from other customers was able to supply enough "oversold" equipment that same afternoon.

This . . . and thousands of other cases . . . illustrates how important are the smallest details . . . how this war in foreign lands reveals the vital importance of proper packing and shipping . . . how often the solution to a fastening problem is the application of some well-proved principle.

Bostitch field men . . . specializing exclusively in stapling . . . backed by forty years' engineering and manufacturing experience . . . will help you select . . . from nearly 800 models . . . the right Bostitch machine to fasten metal, plastics, wood, paper, cloth, rubber . . . in any combination.

Write for Folder B132 or information on any fastening application.

Bostitch (Boston Wire Stitcher Company) 74 Blackmore Street, East Greenwich, R. I. (or Bostitch-Canada, Ltd., Montreal).

Bostitch Staples in most sizes are now available.

BOSTITCH

fastens it better, AND FASTER with wire

ALL TYPES OF STAPLES APPLIED BY MACHINES
ALL TYPES OF MACHINES FOR APPLYING STAPLES

purlins, or in special lengths for special spacing. Deck has overlapping ends made directly over purlins for speedy installations. The material is pressed from steel sheets of No. 18, 20, or 22 gage thickness, and each sheet is finished with one coat of paint. Sheets are lightweight; can be applied to flat or sloping roofs. Rib construction makes it easy to nest sheets together and keep aligned, and sheets can be either welded to purlins or applied with lead headed clinch nails. Different types of insulation can be used on the roofing according to heat requirements, locality, and temperatures. Airtherm Mfg. Co., 700 South Spring, St. Louis 10.

Sweatband

Absorbent sweatband for foundrymen, welders, and workers on hot jobs is made from synthetic sponge. It is 7¼ inches long and covers greater width of the brow. By keeping moisture out of the eyes and off goggles, band helps reduce the possibility of accidents resulting from blurred vision. Band is comfortable, and can be easily sterilized. American Optical Co., Southbridge, Mass.

Square Frame Welder

Welding service range rating of from 60 to 375 amps. is provided by Model WA-300 welder. Of compact design, unit retains two-part construction, single heat control, visual current calibration, and adaptability to parallel operation where higher amperage is needed. Features in-

Again and again, thousands of alert engineers like you have proved that they can make their equipment cleaner cut, less expensive, more compact, more productive when they use a power drive that really fits the job exactly.

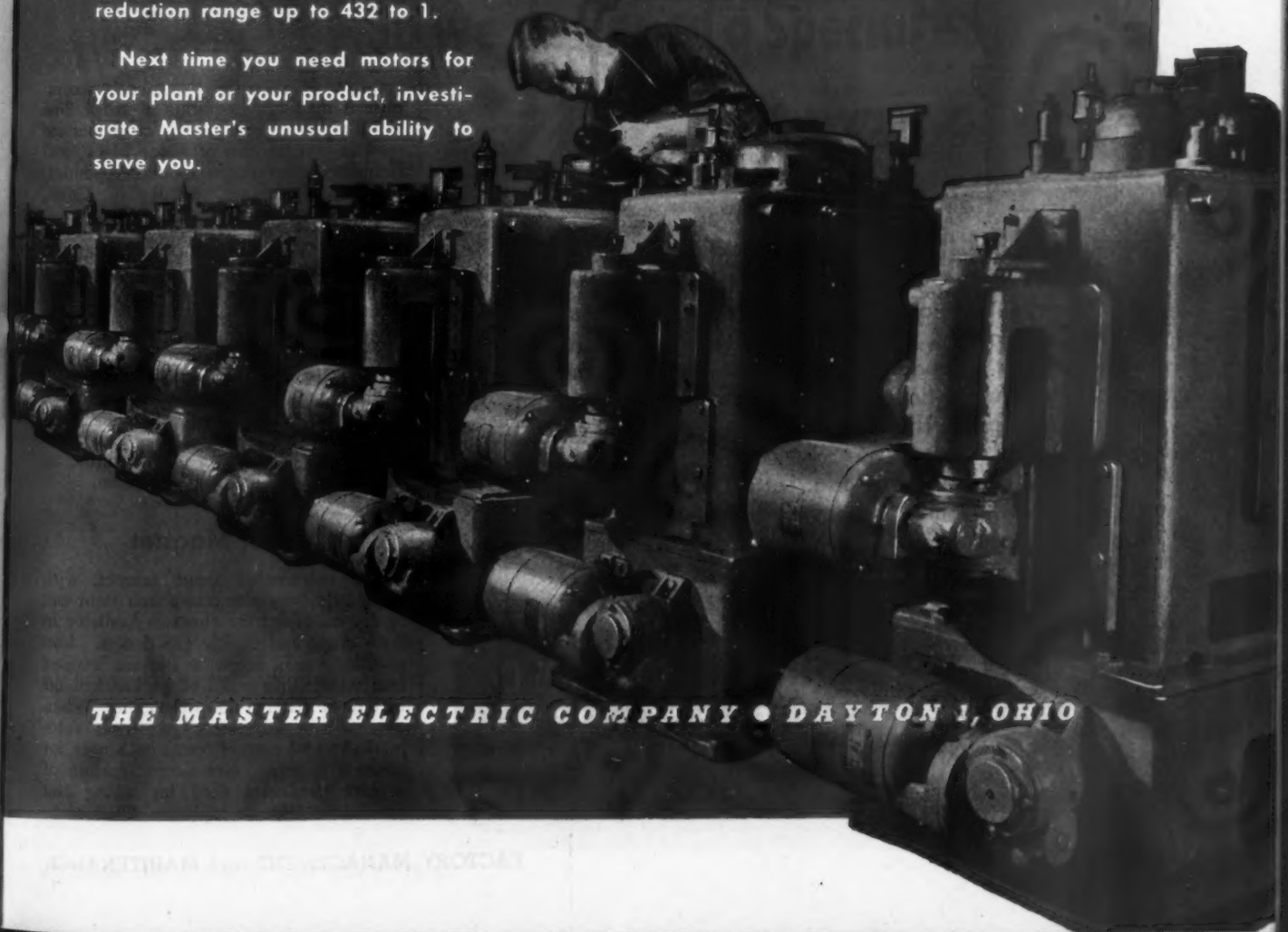
And you'll find it's easier to secure these advantages if you use Master motor drives, because their flexibility and versatility is unmatched anywhere.

For example, look at the motor drives on the machines below. They incorporate a motor and a gear reduction unit and in addition the drive at the bottom also includes an electrically operated brake for quick, controlled stopping. All of these . . . the motor, the gear reduction, and the electric brake . . . all are standard Master units that easily combine into one compact integral power package. Saves ordering and mounting time . . . saves space . . . saves money.

Probably you will not need exactly this same combination of motor features, but Master motors are available in any size from 100 down to 1/10 horsepower and in all cycles, phases, and frequencies . . . in open, splash-proof, fan-cooled, and explosion-proof types . . . with Gearheads, Speedrangers and Unibrakes . . . for every type mounting . . . and over a gear reduction range up to 432 to 1.

Next time you need motors for your plant or your product, investigate Master's unusual ability to serve you.

you can't miss



THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO

WRONG WAY
RIGHT WAY
DETECTO ENDS GUESSWORK IN WEIGHING
Converts ordinary scales into Precision Equipment
DETECTO-GRAM UNIVERSAL HEAD No. 1800

Eliminate overweight and underweight in your weighing operations. Convert one beam scale—or a battery of them—in a few minutes—to accurate, time saving, money saving, weighing equipment. End time losses waiting for a beam to come to rest at *about* correct weight. This head magnifies the balance 9½ times—shows up the tiniest fraction of weight discrepancy. The indicator stops instantly at correct weight.

Try *one* Detecto-Gram Head. Let a Detecto Scale engineer show you *how* much it does to speed work, save money and manpower and end "just-about-right" weighing.

Send for Complete Catalog # 27

DETECTO · SCALES · INC.

MAKERS OF FINE SCALES SINCE 1900

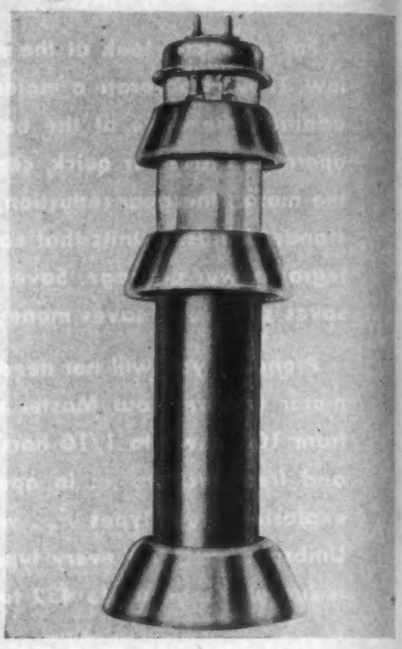
ONE MAIN STREET · BROOKLYN 1, N. Y.

SCALE ENGINEERS IN ALL PRINCIPAL CITIES

clude weatherproof construction, polarity reversing switch, and removable stator, plus overload protection both for contacts and for the low-voltage magnetic starter. Harnischfeger Corp., Welding Div., Milwaukee 14.

High Frequency Tube

High-frequency tube, with an output of 200 kilowatts, for use in industrial heating applications, incorporates a low inductance grid lead with shielding between filament and plate. Tube has three electrodes and an available thermionic emission of 120



amperes. Cooling of the tube is accomplished by water, requiring a steady flow of 40 g.p.m. Sixty pounds of copper are used in construction of anode block, and completed tube weighs about 100 pounds. Federal Telephone & Radio Corp., Newark, N. J.

Companies Change Names

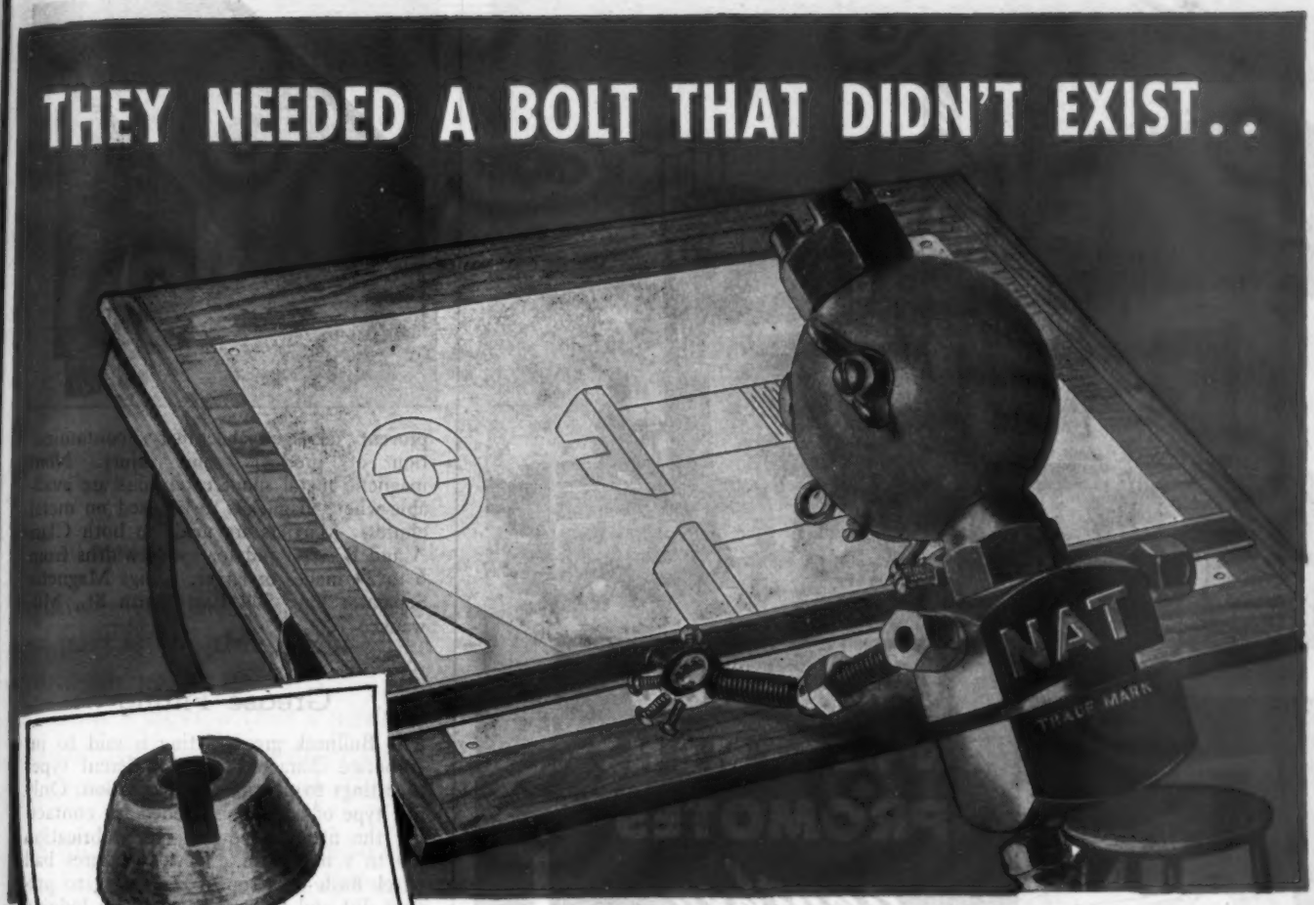
Aeroil Products Company has been adopted as the new name of former Aeroil Burner Company, West New York, N. J., manufacturer of oil-fired, gas-fired, and electrically heated industrial equipment.

Westinghouse Electric & Manufacturing Company, with headquarters in East Pittsburgh, will be known in the future as Westinghouse Electric Corporation.

Spout Magnet

Alnico non-electric spout magnet, with safety gate, separates tramp iron from wet or dry material from chutes. Available in both single and double gap design. Iron particles catch below a step in magnet face where they will not be knocked off by flow of material down the chute. When flow is stopped, safety gate rises automatically and magnet opens on hinges for removal of iron. Non-electric feature of magnet eliminates need for wiring and possibility of fire or explosion. Claimed to

THEY NEEDED A BOLT THAT DIDN'T EXIST..



So we designed a Special Bolt..

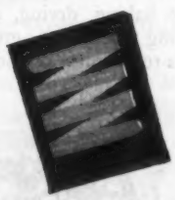
The right fastener for the job!

Here's another typical example of National's Technical Service—a special fastener designed for the particular application when standard fasteners don't meet the need:

In a certain rubber molding operation a bolt was required that could be pulled up tight and used for many applications. Extra large bearing surface was needed, as well as exceptional strength and high "torquing" capacity.

We designed the bolt of alloy steel, with a specially formed slot which permits use of a reinforced driver. This prevents slipping or shearing of the driver point. The large diameter at the base of the head affords ample bearing surface, while the tapered sides reduce the amount of metal in the head, making it possible to upset the bolt, an important cost factor.

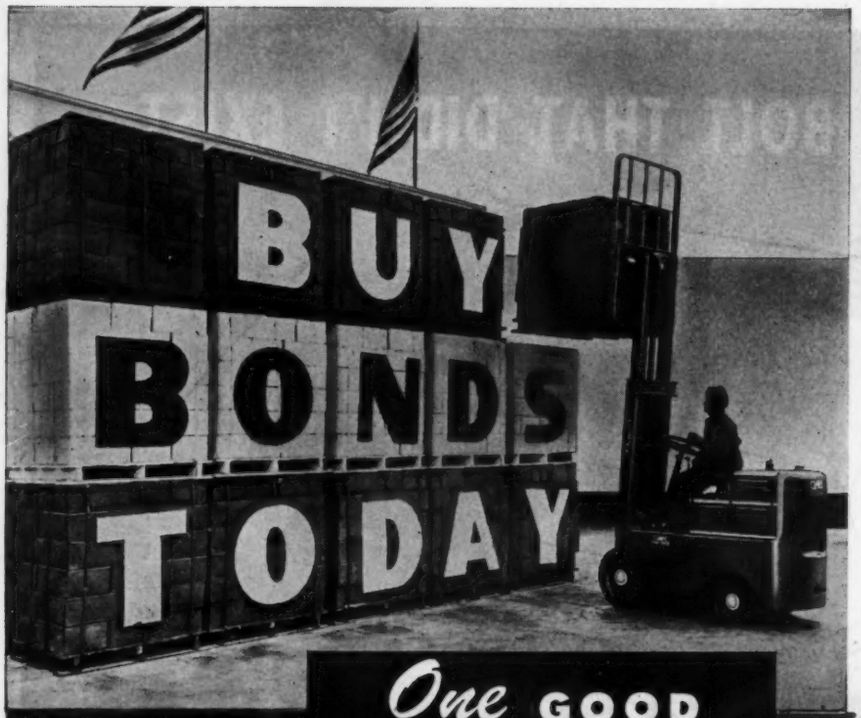
You may need just such a service as this to improve your fastenings. Often we can save production time and cost by upsetting a part instead of milling from bar. Let us have your inquiry.



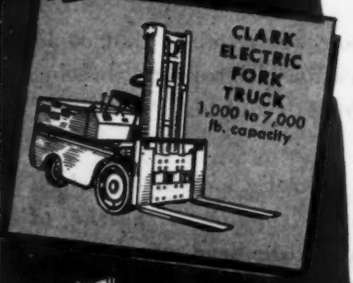
Send for a copy of this case history booklet describing briefly, with diagrams, typical instances of National's Technical Service. Ask for the "Savings" booklet.

National Screw and Threaded Products

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.



One GOOD INVESTMENT PROMOTES another



Cited for extraordinary usefulness and efficiency beyond the call of duty—the flexible, tireless

Pallet and CLARK fork truck

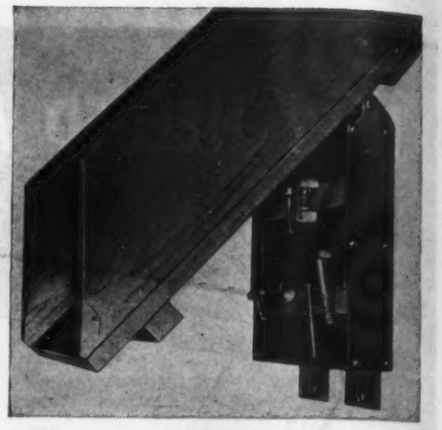
the extraordinary pair that speeds the flow of munitions, food and supplies to the point of use.

To see the wide range of usefulness of Clark Tructractors and Fork Trucks, send for handy 72-page pocket catalog—describes 60 husky, well engineered vehicles, gas and electric powered.

Manufactured PRODUCT of CLARK EQUIPMENT COMPANY

CLARK TRUCTRACTOR
BATTLE CREEK, MICHIGAN, U.S.A.

Products of CLARK • TRANSMISSIONS • ELECTRIC STEEL CASTINGS
AXLES FOR TRUCKS AND BUSES • AXLE HOUSINGS • BLIND RIVETS
INDUSTRIAL TRUCKS AND TRACTORS • HIGH-SPEED DRILLS AND REAMERS
METAL SPOKE WHEELS • GEARS AND FORGINGS • RAILWAY TRUCKS



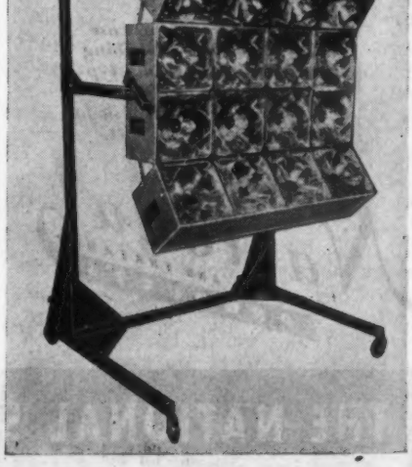
prevent damaged machinery, contamination of products, and injury. Nonmagnetic metal spout extensions are available where magnet is to be used on metal chutes. Magnets are made in both Class A and B sizes, and for spout widths from 6 to 24 inches or larger. Dings Magnetic Separator Co., 509 East Smith St., Milwaukee 7.

Grease Fitting

The Bullneck grease fitting is said to incorporate characteristics of different types of fittings to permit standardization. Only one type of coupler is needed for contacting the fittings, reducing the lubrication job to a minimum. Device features ball check flush with top of the fitting to prevent dirt and foreign matter from lodging in opening. Inside diameter allows large volume of lubricant flow, and bearing pad permits even distribution of wear on both coupler jaws and fitting. Inside diameter of passage in the fitting head is slightly less than diameter in body, preventing ball check spring from collapsing under pressure. Lincoln Engineering Co., 5701 Natural Bridge Ave., St. Louis 20.

Portable Infra-Red Units

For multiple baking, drying, dehydrating, and preheating operations, group of four mobile infra-red units provide radiation



★ ★ ★ ★ ★

What!... Voluntarily lower the price on a contract already awarded?

Don't be silly!

To lower the price on a contract involving a *new* part is one thing. But when you "bid in" at a lower price than anyone else on a contract covering a device that's already history—and still reduce the figure after the deal is closed—it's something altogether different.

Specifically . . . a contract to turn out a special aluminum part for a major company making automatic pilots for Uncle Sam's fighter planes.

We Cut Our Original Bid to Less Than Half.. And On Top of It Broke a Bottleneck

We bid low, at $38.10 per unit. Up until then, each part required 54 inches of intricate welding—and there had been a shortage of welders capable of doing it. Rejects at testing had been 40%. It had been possible to make only 500 a week.

To boost the output, we looked for a better way of doing it. The answer turned out to be "impact extrusion". Heretofore, manufacturers had used it only for small parts, limited to 2 inch diameter and 3 inch draw. In the process, we eliminated all but approximately 9 inches of welding—plus the need for critical aluminum tubing. Rejections dropped to about 2%. Production jumped to 500 a day, instead of 500 a week.

Our contract price $38.10—but we billed $18.85.

So, Uncle Sam gets the automatic pilots he needs . . . the prime contractor cuts his costs (on top of our original low bid)—and we're feeling very good about it.

Perhaps the fact that we have been in the subcontracting business for over 50 years has something to do with our ability to improve part designs, cut production corners and lower costs.

★ ★ ★

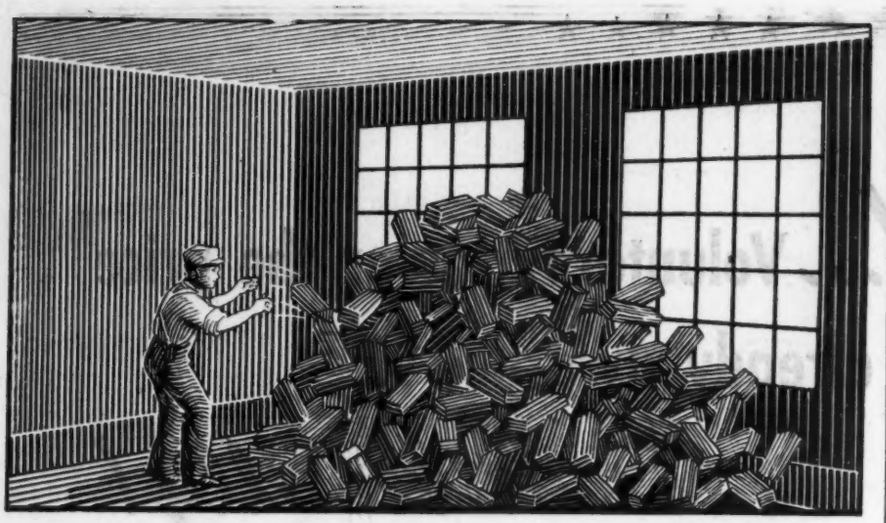
Write on your business stationery for 48-page book, "Let Lewyt Do It"—the story of the Lewyt organization in pictures. Lewyt Corporation, 60 Broadway, Brooklyn, N. Y.

ARMY E NAVY

Lewyt

A CONTRACT MANUFACTURER—EXPERTLY STAFFED TO PRODUCE COMPLETE ELECTRONIC AND MECHANICAL ASSEMBLIES, COMPONENT PARTS AND SUB-ASSEMBLIES, TO THE MOST EXACTING REQUIREMENTS

CONTINUE BUYING WAR BONDS



What's Wrong With This Picture?

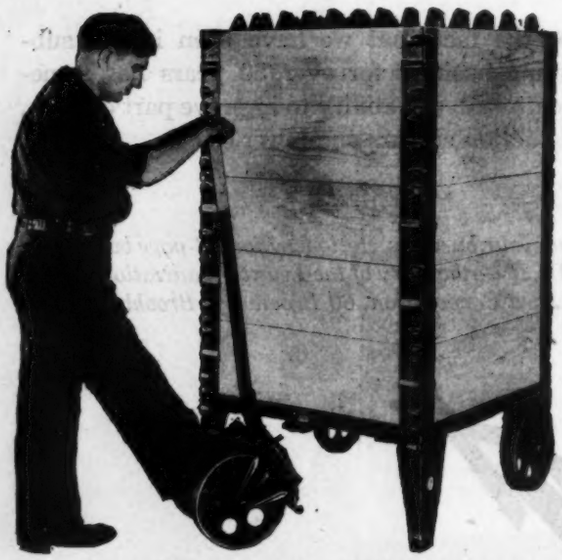
Well, of course anyone knows that materials shouldn't be piled up against windows that way. But the picture shows something much worse than that — a procedure which is wasting time and money in thousands of American industries. Is yours one of them?

You know the answer instantly if you have the

TURNER SYSTEM
OF MATERIALS HANDLING

This remarkable system will show you that piling materials as shown in the picture WASTES TWO-THIRDS OF THE FLOOR SPACE! Bad? Yes — but practically nothing compared to the WASTE IN LABOR of "laying them down" and "picking them up." Such labor cost is like throwing money away.

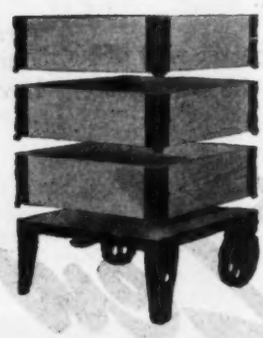
With the Turner System these materials are OFF THE FLOOR — in Bin Sections stacked as high as the ceiling if desired — ready to be moved QUICKLY to any assembly or other plant location. There is no "laying down and picking up."



Square Transport is easily moved in restricted space by hand Jimmy, power lift truck, crane or conveyor. Steel or Wood Bin Sections are applied as needed.

ONE OF TEN FEATURES

Only one of ten cost saving features of the Turner System is the idea of Bin Sections on movable Transports. Bins as high or low as the job requires are always available. As load diminishes Sections are removed for better handling, placed on "empty" to build its capacity.



60 DAYS FREE TRIAL

You may see for yourself how Turner Units save costs in your own plant. Use them for 60 days. Return them if they don't prove their worth. Write for details.

GET THE TURNER SYSTEM BOOK

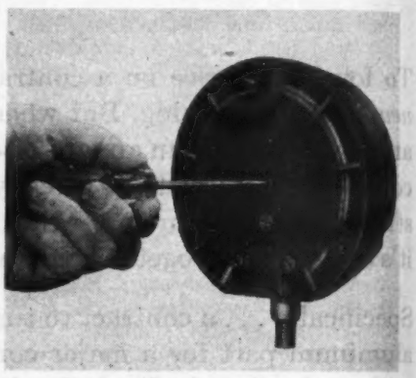
All ten Features of the Turner System are described in a twenty-page book. Write for it on your letterhead.

FACTORY SERVICE COMPANY
4605 N. TWENTY-FIRST ST. MILWAUKEE 9, WISCONSIN

coverage ranging from 275 to 2000 square inches. Reflector assemblies are attached to upright support and base by an arm equipped with rotating swivel device that permits radiation in any direction. Assemblies are flexible, moving up or down on the upright. Models utilize either gold-plated reflectors or gold-reflecting surfaces. Wired to accommodate lamps ranging from 125 to 500 watts, 120 volts. Heavy duty casters permit easy rolling, and design prevents tipping. The Fostoria Pressed Steel Corp., Fostoria, Ohio.

Pointer Adjuster

All pressure gages made by this company are now equipped with hairline pointer adjusters, enabling pointers to be reset without removing glass or ring. Slotted adjusting screw in back of case changes



relative position of roller and cam of the Helicoid movement, thereby changing position of pointer. Fine adjustment is said to be obtained by slight turn of the screw. Certified Gauge & Instrument Corp., Maytag Bldg., 34th St., Long Island City 1, N. Y.

Steam Cleaning Compound

Heavy-duty steam cleaning compound, named Steam-Off, has been developed. Claimed to be effective in removal of heavy, stubborn grease and dirt from iron and steel surfaces, concrete, brick, and structural materials, gasoline and diesel engines, and other machinery. Product combines quick cleaning energy with ability to soften water, produces clean work, rinses freely, and leaves no film, curds, water spots, or streaks, according to manufacturer. Used as stronger solution, compound can remove unwanted painted surfaces as it cleans. Turco Products, Inc., 6135 South Central Ave., Los Angeles 1.

Direct-Fired Heater

Compact heat-producing and distributing unit, burning either gas or oil, is designed for suspension from walls or roof trusses. Heater is suitable for use where space for floor units is not available. Warm air from heater can be discharged in any direction by regulating adjustment of nozzles. Directional louvers on each nozzle channel the flow up or down. Hot air is driven from nozzles at velocities of 1800 to 2000 feet

You'll want all the production capacity possible from new, improved electrical equipment. Then don't let inadequate wiring rob you of equipment performance you pay for. Assure sufficient current for efficient operation of future electrical apparatus.

Remember, wiring won't stretch. Check up on your wiring plans *now!* It's far wiser to change blueprints than risk costly alterations later. This is the time to call in consulting or plant power engineer—electrical contractor or power salesman. They'll advise *foresighted* wiring. Anaconda Wire & Cable Company, Subsidiary of Anaconda Copper Mining Company. General Offices: 25 Broadway, New York City 4. Chicago Office: 20 North Wacker Drive 6. Sales Offices in Principal Cities.

Get the performance you pay for in modern equipment—

Wire ahead

You wouldn't accept equipment that performed only part way—then why let inadequate electrical wiring cut production efficiency?
HELP BRING VICTORY SOONER
. . . BUY MORE WAR BONDS
ANACONDA
ANACONDA WIRE & CABLE COMPANY

TIGHT VALVES CONSERVE FUEL

PREVENT HOLD-UPS IN PRODUCTION

LUNKENHEIMER VALVES STAY TIGHT WITH LESS CARE

With today's production problems and the urgent necessity for conserving fuel, it is more important than ever to avoid wasteful, costly, production-lowering valve leakage. It's good business to maintain a regular check on valves, to make sure that they are *tight* and in proper working order. Maintenance men prefer Lunkenheimer Valves. They know these *quality-built* Valves serve longer and better on the job—are easier to keep tight with a minimum of time, labor, and expense.

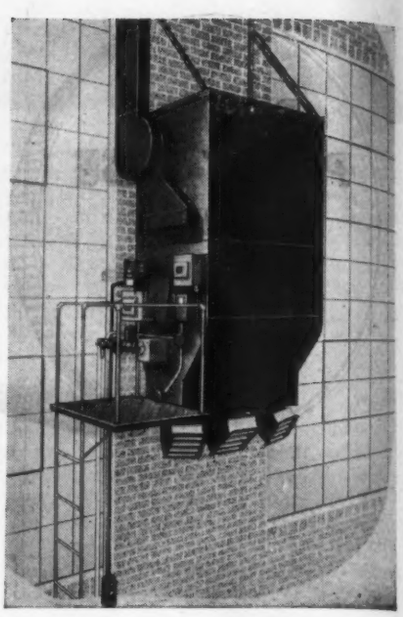
The Lunkenheimer Co., Cincinnati 14, Ohio, U. S. A.—*Branch Offices:* New York 13, Chicago 6, Boston 10, Philadelphia 7. *Export Department:* 318-322 Hudson St., New York 13, N. Y.

Fig. 123 "N-M-B" Globe (Non-Metallic Disc)
Fig. 2125 Bronze Gate
Fig. 16 "Renewo" Globe
Fig. 1640 "King Clip" Gate
Fig. 1430 Iron Body Gate

A Lunkenheimer Distributor is located near you, ready at all times to assist with your maintenance and operation problems. You will profit by using his service.

LUNKENHEIMER VALVES

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S. P.; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS



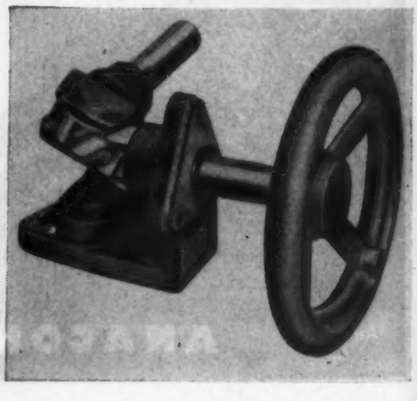
per minute, enabling the heaters to be located from roof trusses or wall brackets 30 or more feet above the floor, and still deliver the heat load efficiently to working area. B.t.u. output per hour ranges from 300,000 to 1,650,000, depending on size of heater. Lower half of combustion chamber is lined with plastic refractory molded to the metal wall. Dravo Corp, Pittsburgh 22.

Cleaning Compound

Water soluble compound, called Tri-San, is claimed to deodorize, clean, and disinfect surfaces in one operation. Has no odor, and leaves none. Safe to use, it has various industrial applications, where odor control and inhibiting mold growth are problems. Packaged in 45-lb. pails, 110-lb. kegs, and 300-lb. barrels. Oakite Products, Inc., 22 Thames St., New York 6.

Link Joint

Type H universal link joint features adjustable link mechanism to transmit rotary motion around corners, permitting operation of shafts at angles adjustable from a straight line to a right angle. Output shaft turns in the exact angular rotation as input shaft, giving input turning angle equivalent to the output turning angle. The joint is mounted by three screws. Bearing arm, which holds the adjustable



G-W HANDLES IT – Faster • Easier • Cheaper

Gear your infra-red operations the "G-W Way", by coordinating conveying with spraying, baking and drying operations. To get all the advantages of infra-red convection heating, conveying equipment must be planned to: reduce work travel; process in transit; speed spraying, dipping, drying and finishing operations; cut down space, power and number of operators; reduce amount of "rejects".

Designing infra-red systems expressly for individual plants, synchronizing the component operations, is the "G-W Way" – a way based upon 130 years of specialization in designing industrial mechanical handling systems . . . now applied to infra-red by one of the pioneers in advancing this method for faster finishing.

If you are oven-baking finishes on metal products, look ahead with infra-red. Gifford-Wood will design, produce and install a complete system for you, including conveyors, lamps and allied equipment. Ask a G-W representative to make recommendations to fit your plant operations. Gifford-Wood Co., 420 Lexington Ave., New York 17, N. Y.; 565 W. Washington Street, Chicago 6, Ill. Factory – Hudson, N. Y.

GIFFORD-WOOD

SINCE 1814

DO YOU KNOW?

Gifford-Wood is Handling Headquarters for Ice Processing Equipment and Ice Handling Tools . . . for Coal and Ash Handling Systems . . . for Industrial Conveying and Elevating Equipment.

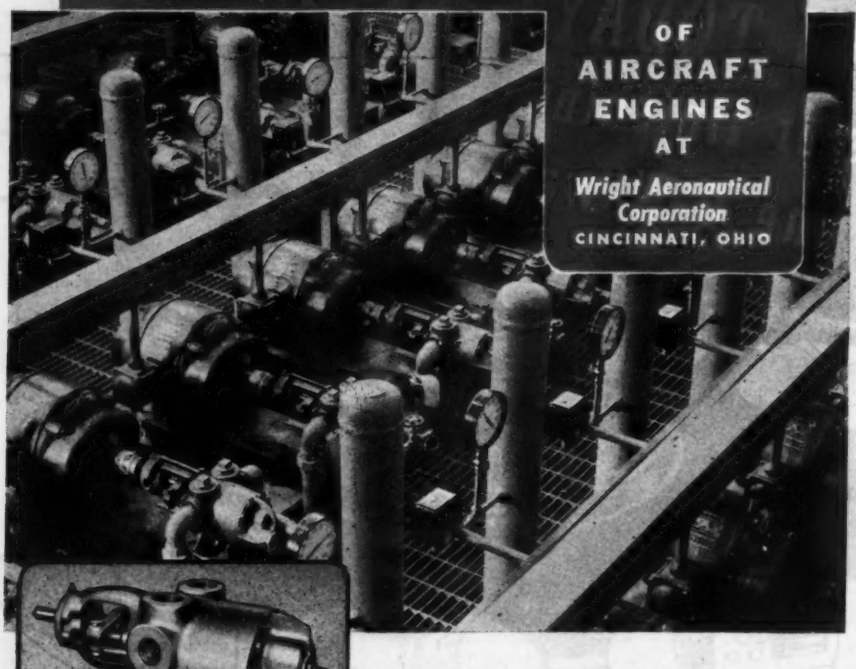
7620

HOW A MODERN PUMPING STATION FACILITATES MASS PRODUCTION

OF AIRCRAFT ENGINES AT

Wright Aeronautical Corporation

CINCINNATI, OHIO



JOB FACTS

Roper Series F pumps used on job, each engineered to handle a variety of cutting oils. Rated capacity 20 g.p.m. with relief valve set at 150 lbs. All are mounted on individual bed plates with 3 H. P., 1750 r.p.m. motors controlled by pressure switches. Pumps can be disassembled — gears, case and bearings inspected or replaced — without disturbing pipe connections or mounting.

FREE ENGINEERING SERVICE

A staff of competent, experienced Roper engineers are ready and willing to help you solve your pumping problems. There is no obligation. Simply send us details of your problems, or get in touch with Roper field engineers located in principal cities. Ask for free catalog, also booklet, "How To Solve Pumping Problems".

BIG BANK OF ROPER PUMPS SPEED HANDLING OF OILS

This big bank of Roper pumps at Wright Aeronautical Corporation, move thousands of gallons of cutting oils to huge machine tool batteries. Through delivery lines that run from a central station directly to the scene of operation, they quickly dispatch a variety of oils to serve production requirements.

This modern facility of a modern production plant saves time and manpower . . . eliminates inter-plant delays and inconveniences associated with transporting large quantities of oils. It's a pump job engineered by Roper in collaboration with plant engineers to help maintain speedy production of vital aircraft engines. Perhaps Roper can also help you in working out a solution to your problems. Call on experienced Roper service engineers, located in principal cities, or write factory today.

GEO. D. ROPER CORPORATION

ROCKFORD, ILLINOIS

Write for Catalog No. 7-38

It illustrates and describes Roper design, construction, range of models, and how they may be adapted to fit individualized requirements.

PUMPS ESPECIALLY ENGINEERED TO FIT YOUR REQUIREMENTS

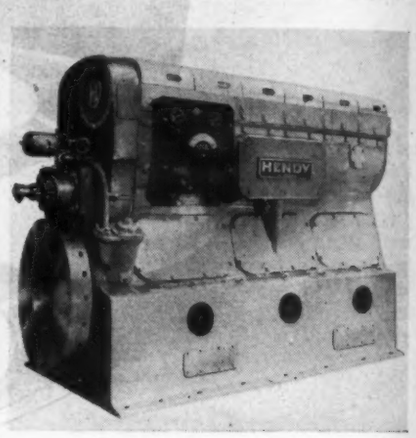
ROPER *Rotary Pumps*

BUILDERS OF PUMPS FOR MANUFACTURING, MARINE, PETROLEUM, AND PROCESS INDUSTRIES

shaft, may be hinged to any desired position from 0 to 90 degrees, and is held there by a locking screw. Applicable for hand operation and slow speed power drives such as used in controls of electrical switchboards, electronic equipment, automatic machinery, valve operation, and other mechanical devices. Piezoelectric Corp., 110 East 42nd St., New York 18.

Diesel Engines

Series 20 diesels, in 6- and 8-cylinder models, with power range of from 190 to 250 horsepower at 900 r.p.m., are now on the market. Stationary and diesel-electric models, 4-stroke cycle type, designed for heavy-duty, medium-speed operation. Units are air starting and completely enclosed, with overhead camshaft, unit fuel



pumps and injectors, precision-type bearings, and full pressure lubrication. Engines have cast-iron, mono-block construction, with underhung crankshaft, removable cylinder liners, and auxiliary drives at either end. Joshua Hendy Iron Works, Sunnyvale, Calif.

Belt Dressing

New formula Grako liquid belt dressing is claimed to increase transmission capacity 20 percent or more. Regular use is said to lengthen life and keep the belting pliable and transmission capacity high. Maker states that dressing pours readily at 32 deg. F., will not cake or gum-up on pulleys and belts, and is adaptable for conditions where steam and water are troublesome. Graton & Knight Co., Worcester 4, Mass.

Portable Test Set

Self-contained portable 100,000-volt a.c. test set, for testing heavy apparatus that cannot readily be moved to stationary test bench or laboratory, has a capacity of 10 kva. Unit, which is suitable for conducting tests on large high-voltage equipment, consists of oil-immersed step-up transformer, hand-operated induction regulator for voltage control, double-scale output voltmeter, electric timing clock, overload relay with automatic reset, and two-pole magnetic contactor. These parts are enclosed in steel housing mounted on 4-wheel truck. Voltmeter is arranged for high degree of accuracy throughout the com-

As in these plants . . .

GULF QUALITY PETROLEUM PRODUCTS

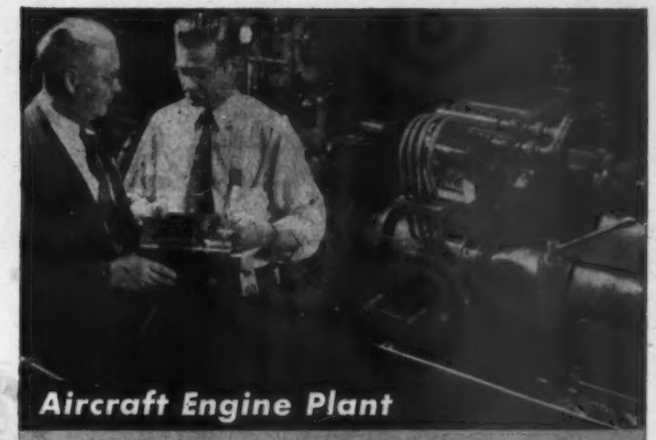
can help you increase output and reduce costs

THESE three cases are typical! Plant operating men from Maine to New Mexico report similar benefits from the use of Gulf quality products.

Have you talked with a Gulf Engineer about the possibility of making further production improvements through better selection and use of oils and greases? He is familiar with many recent developments, has had broad practical experience, and can help you cash in on the benefits that can be obtained through modern petroleum science and lubrication practice.

Gulf Cutting Oils, for example, used as recommended by Gulf Engineers, have helped step up production on the toughest metals used by the armament and aircraft industries. Many special Gulf products, developed by research before and during the war, have helped plant men make phenomenal production records on war materiel.

To reduce your maintenance costs and increase operating efficiency, call in a Gulf Service Engineer today. The Gulf line of more than 400 quality oils and greases is available to you through 1200 conveniently located warehouses in 30 states from Maine to New Mexico.



Aircraft Engine Plant

This machine fins 67% more aircraft cylinder barrels since the proper Gulf Cutting Oil replaced another cutting fluid—and tool life has been increased over 100%.

Tank Transmission Plant

By switching to Gulf Cutting Oils, this gear-hobbing department increased production and eliminated rejects due to tearing.

Coal Mine

Better lubrication with Gulf quality lubricants cleared up clutch trouble in loading machines. Result: increased tonnage, and lower maintenance costs.

GULF INDUSTRIAL LUBRICATION

Helps make machines produce more at lower cost

Gulf Oil Corporation · Gulf Refining Company

Gulf Building, Pittsburgh 30, Pa.

Morton's SALT TABLETS

NOW AS FAMILIAR AND NECESSARY AS THE FIRST AID STATION

In the middle thirties salt tablets were a novel idea. Today practically all leading industrial plants wouldn't think of eliminating either salt tablets or first aid stations. Both are essential — the one to help prevent accidents, the other to repair them.

When workers sweat, their bodies lose essential salt. This loss causes Heat-Fag, inalertness, fatigue, heat prostrations. Accidents increase. Production goes down.

Morton's Salt Tablets at every drinking fountain provide an easy, simple, effective way to restore this vital salt lost through sweat. The cost is less than a cent a man per week.

In salt tablets, as with other grades and types of salt, Morton is the recognized leader. Order Morton's Salt Tablets and Dispensers from your distributor or directly from this advertisement. Write for free folder today . . . Morton Salt Company, 310 S. Michigan Ave., Chicago 4, Illinois.

MORTON'S DISPENSERS

They deliver salt tablets, one at a time, quickly, cleanly—no waste. Sanitary, easily filled, durable.

800 Tablet size - - $3.25

MORTON'S SALT TABLETS

Morton's Salt Tablets are available either plain or with dextrose.

Case of 9,000, 10-grain salt tablets - - - - - - - $2.60

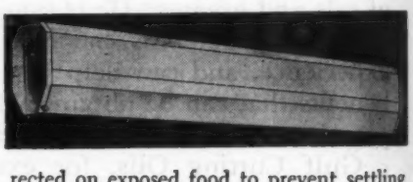
Salt Dextrose Tablets, case of 9,000 - - - - - - $3.15

MORTON'S SALT TABLETS

plete voltage range up to 100,000 volts, at all loads and power factors, permitting precision measurements of the applied voltage, maker claims. Safety foot switch, that must be held down during test, instantly de-energizes the set when it is released. Has protective screen-guard located between high-voltage bushing and operator's working position. Transformer Div., General Electric Co., Schenectady 5.

Ultra-Violet Fixtures

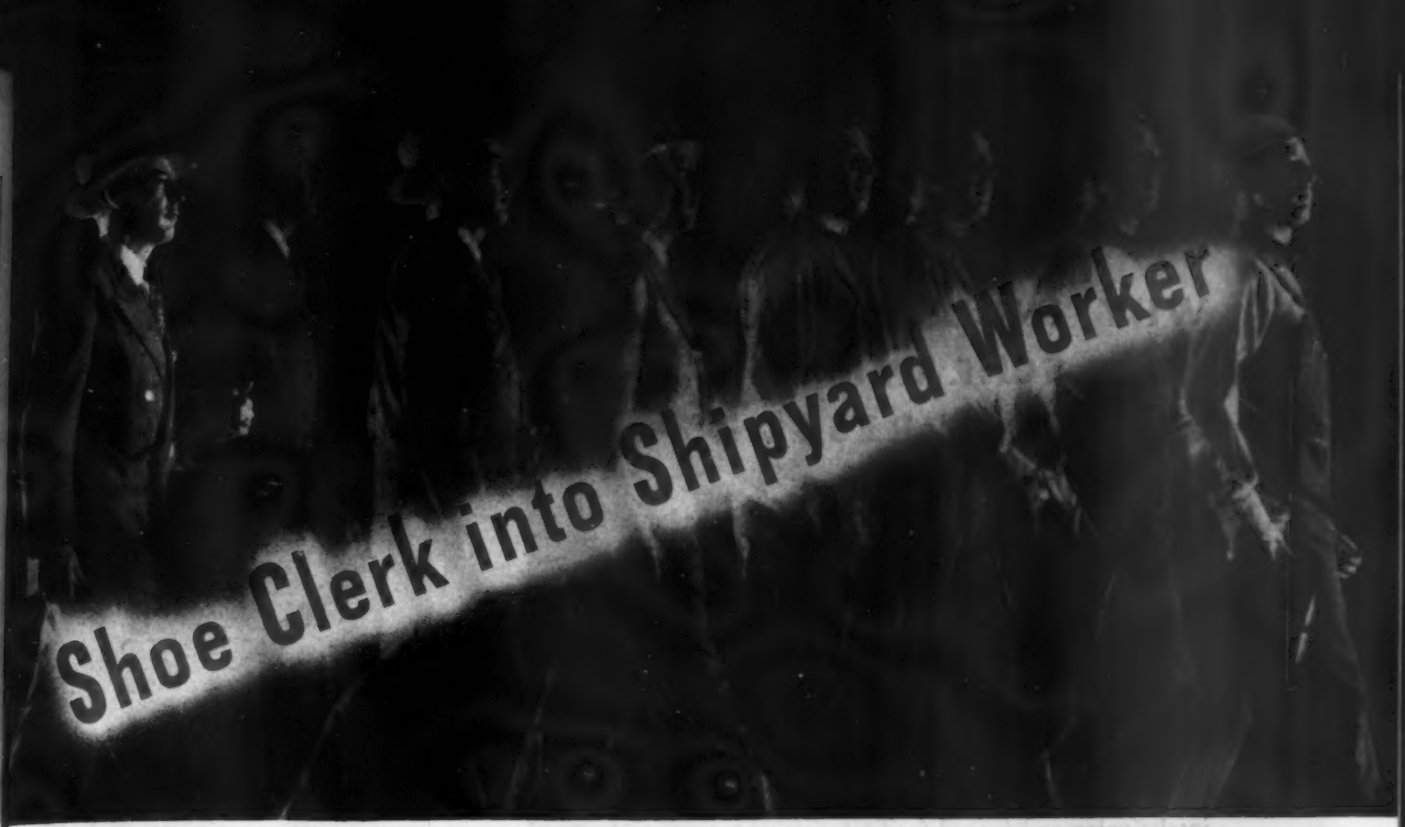
Equipped with highly concentrating Alzak reflector, ultra-violet fixtures can be arranged to curtain off an area against outside germs, according to manufacturer. Over food counters, the beam can be di-



rected on exposed food to prevent settling of air-carried germs. Known as the Barrier germ-killing light, it is available in two sizes, for use with 15- and 30-watt germicidal lamps. The Edwin F. Guth Co., 2615 Washington Ave., St. Louis 3.

Fitting for Flexible Tubing

Welded or brazed Type W fitting is made in any standard size. Said to be suitable for vibration and medium internal pressures at any temperature commensurate with the heat-resisting qualities of metals involved, to be rugged, and suitable for continuous all-around service. The weld ends project into tubing for axial alignment, and the braid-protecting sleeves are



He learned "overnight" through movies

LOOK back to the early days of the war—with war plants roaring into production—hundreds of thousands of "green hands" swinging into strange, new jobs. How well was the job done? Read the newspaper headlines!

Actually—in training films—a superb "mass production" method of teaching wartime skills to white collar workers and others was ready at hand. Again, when shifting military needs demanded a shift in *types of production* ... training films eased the conversion...

Competent authorities state that—"Industrial training time was cut 25% to 30% ... Army training time as much as 40% by use of movies"

How wide in scope?

Training films teach practically anything... new operational methods... safety and health ... leadership ... objectives of management.

And it's better instruction—without favoritism or other upsetting personal elements. That's important!

Most significant of all—tests show that movie-taught groups retain 38% more of the information imparted than was retained by groups taught in other ways.

Draw your own conclusions!

Three obvious paths are open ... the choice is yours. You can let workers stumble in the dark—learning by trial-and-error methods, wastefully ... or ... you can let skilled workmen waste valuable time and materials while instructing new employees, and retraining old ones ... or ... *you can let training films do a whale of a teaching job on what is virtually a production basis!*

Remember, training films have *proved* how efficiently they can teach wartime routines to all sorts of workers ... under pressure. Now, as industry moves in to fill the first essential orders for consumer goods, training films will prove themselves equally efficient as an aid to worker-reconversion ...

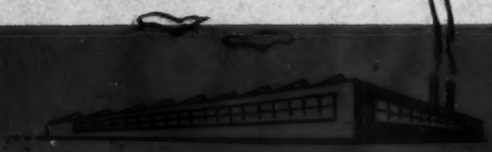
The professional skill of your commercial producer is an absolute *must* in the planning and creation of effective training films. He's a specialist in his line—brings creative "know-how" to bear on your own specific teaching problem. That's his specialty. Eastman Kodak Company, Rochester 4, N. Y.

TRAINING FILMS

create "KNOW-HOW" by "SHOW-HOW"

faster instruction ... at lower cost
... uniform ... and more lasting

Kodak



WHY INDUSTRY USES SCHRAMM AIR COMPRESSORS

There are many compressed air jobs to be done in Industry, and into this versatile picture fits the Schramm Air Compressor. Either portable or stationary, Schramm enables compressed air jobs to be done quickly—easily—economically!

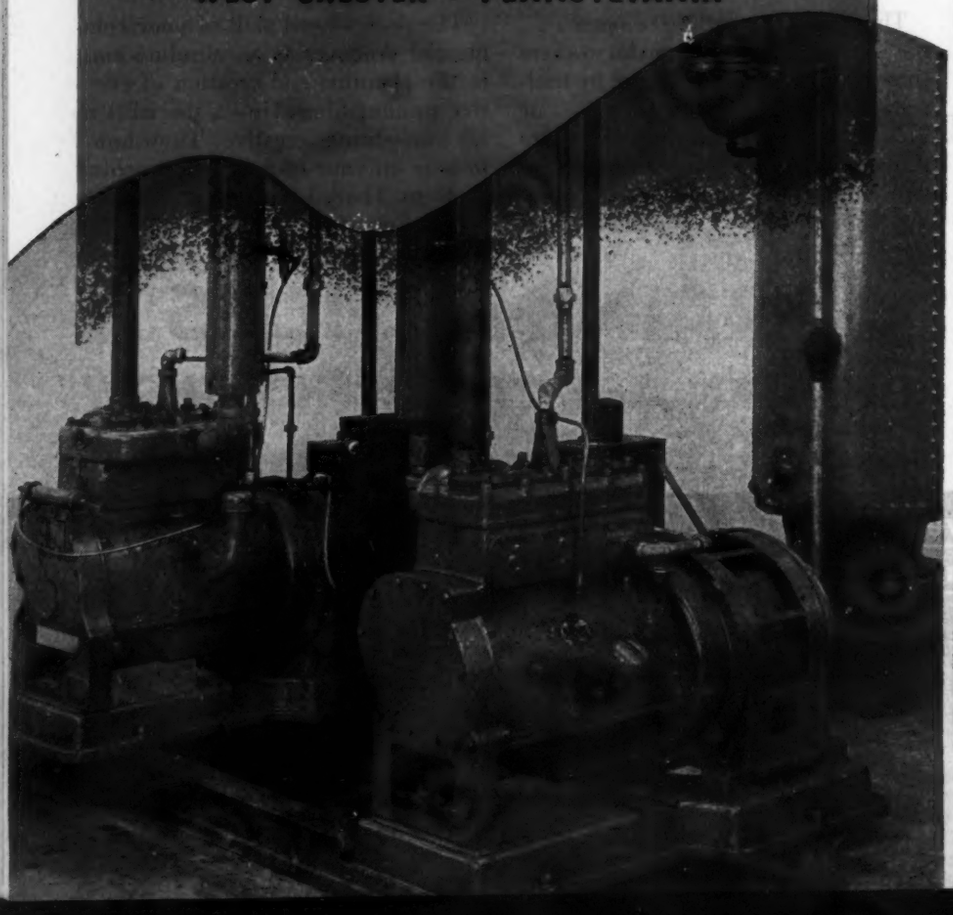
Schramm Compressors are *better* because they are 100 per cent watercooled . . . compact and lightweight . . . have mechanical intake valve and forced feed lubrication!

Schramm's come in a variety of sizes. So whatever your need for compressed air . . . there's a Schramm to do the job. Write today for illustrated booklets and plan to use a Schramm in the New Era now facing industry!

SCHRAMM INC.

THE COMPRESSOR PEOPLE

WEST CHESTER • PENNSYLVANIA



heavy-gage seamless tubing. Bell-shaped contours on inside of free ends prevent damage to braids. Seamlex Co., Inc., 2725 Jackson Ave., Long Island City, N. Y.

Steel Stamp

Clear impressions are claimed obtainable without chipping or mushrooming striking head with recently developed steel stamp. Made for marking letters and numbers.

stamps are known as Rams Head. Acme Marking Equipment Co., 2222 West Fort St., Detroit 16.

Wire Rope Slings

Registered wire rope slings are announced, which will be accompanied by a certificate of test and registry for the benefit of the sling user. This certificate furnishes a permanent record of the original strength rating of the sling, the safety factor upon which that rating was based, the actual proof load, and conditions of the sale. Each sling carries a metal tag that shows registry number, sling type, and maximum load rating. This registered program includes all of the following types of wire rope slings: Conventional wire rope slings, braided wire rope slings, and cable-laid slings. American Cable Div. and Hazard Wire Rope Div. of American Chain & Cable Co., Bridgeport, Conn.

Portable Kilovoltmeter

Portable kilvoltmeter, known as No. 759, has 5 ranges that provide 1, 2, 5, 10, and 20 kv. d.c. at full scale. Accuracy of the built-in meter is said to be ±2 percent. Features include reversing switch that makes it unnecessary to change connections to the terminals of the instrument if polarity is reversed. Binding posts are available so that an external meter may be used if full scale accuracy better than 2 percent is required. The resistance multiplier section is adjusted within 0.1 percent so that more accurate meters may be used with the external connection, if re-

McCASKEY TOOL CRIB CONTROL will help you reduce manufacturing costs . . . and here's how . . . .

The McCaskey System definitely records employees' responsibility for tools. No time wasting disputes occur when tools are returned or employees quit. As a result, the loss or theft of tools is practically eliminated.

Here's a case in point, taken from the statement of a well-known plant using McCaskey Control:

Under the old system, the cost of the cutting tools, gages, micrometers and other tools that were lost, strayed or stolen each year amounted to a considerable sum. Under the present system (McCaskey), the loss of a tool is very rare indeed. The crib attendant knows where each tool is and can locate it instantly. Thus the arguments that wasted time and ruined otherwise good dispositions in days of yore have been completely eliminated.

This is only one of numerous advantages of McCaskey Control that help reduce over-all production costs by cutting tool costs.

Let us have a representative explain how McCaskey Tool Control can be installed in the busiest cribs without disturbing production in the least . . . or send you factual reports on McCaskey savings in several well-known plants.

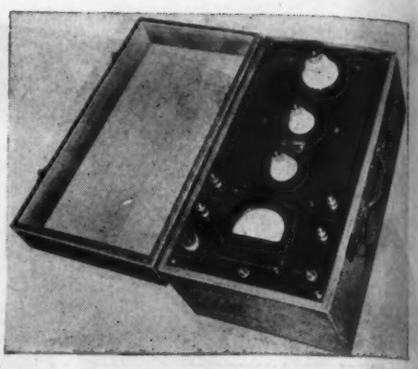
THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

OTC
MAINTENANCE
TOOLS
SHORTEN DOWN TIME
on MACHINE TOOLS
Maintenance and repair jobs are speeded up SAFELY—with the OTC PULLING SYSTEM. It removes and replaces gears, bearings, sheaves, pulleys, shafts, wheels and other close-fitting parts—easily, quickly, without damage to critical parts, without back-straining labor. Reduces injury risks. Approved by Timken, SKF, Hyatt, M-B-C and New Departure for use on their bearings.
OTC GRIPOMATIC PULLERS, PUSH-PULLERS, Pulling Attachments and Adaptors, BOX WRENCHES and other tools are made in sizes to handle practically every maintenance job.
ASK YOUR SUPPLY HOUSE—or write for Instructive Maintenance Bulletin.
OWATONNA TOOL CO.
363 CEDAR ST., OWATONNA, MINN.



quired. This permits individual taps of the multiplier to be used as accurate high resistance standards. Shallcross Mfg. Co., Collingdale, Pa.

Directory

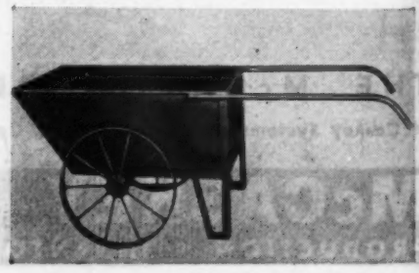
Directory placed prominently in shop or office designates those in authority. Standard size 24x20 inches. Frame is wood, in any one of several standard color finishes to match woodwork or surroundings. For offices it is available in mahogany, walnut, maple, or ebony. Background for names is

DIRECTORY
FACTORY OFFICE
ROOM
W. H. GREF, WORKS MANAGER 201
H. R. HAFNER, SUPT. OF MFG. 202
F. BAILEY, ASST. SUPT. OF MFG. 203
F. DANBY, PRODUCTION ASST.
J. H. KENEFICK, ASST. TO MFG. SUPT.
A. MCLEAN, ASST. TO SUPT. OF MFG.
D. A. GARDINER, SUPT. 2ND SHIFT
K. LEWIS, TOOL ENGINEER 204
C. WOOD, ASST. TO TOOL ENG.
A. KREIGER, TOOL ROOM FOREMAN 205

made of black felt grooved wood, and the removable letters are white or red celluloid said to be non-curling and non-fading. Hinged glass door with lock keeps out dust and dirt, and prevents tampering. The Arcomark Co., 325 Morrell St., Elizabeth, N. J.

Multi-Purpose Cart

Hauling and dumping scrap, small parts, mixed concrete, liquids, and other materials, are functions of cart now on the market. Designed and balanced for easy wheeling as well as convenient dumping, it has a heavy steel body with reinforcing flange around top edge. Tubular handles extend 34 inches from body. Legs are of



SPEEDS the thing...

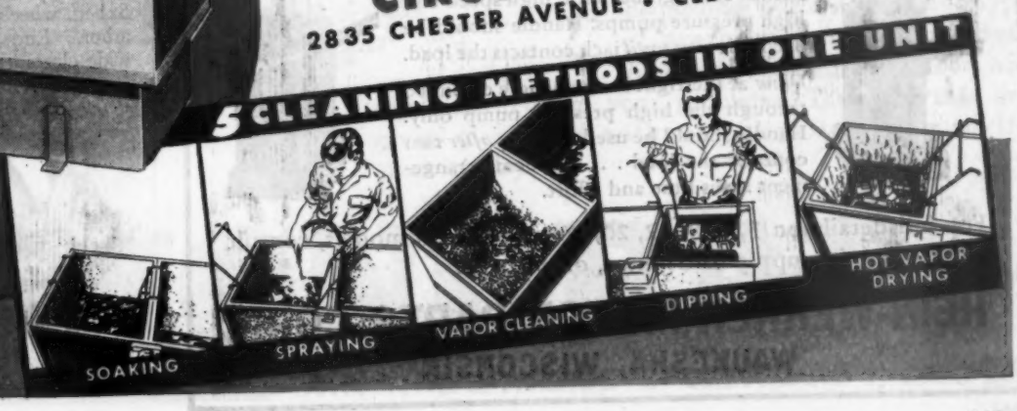
in Parts Cleaning that means Circo Chief Degreaser

Speed combined with thoroughness in parts cleaning means greater production, less man hours, less effort, lower costs, higher profits, and that's exactly what you get with the new Circo Chief twin tank degreaser. Circo Chief's time schedule is minutes instead of the usual hours wasted in cleaning parts, a savings in time alone that will pay for the unit. This remarkable parts cleaning degreaser cleans dirty, greasy parts five different ways—hot vapor cleaning (automatic), spraying (automatic), drying (automatic), soaking and dipping, choice of which depends upon condition of parts.

Circo Chief automatically hot vapor cleans and dries greasy parts in three minutes, and that means every nook and corner of all parts are thoroughly cleaned.

Anyone can operate a Circo Chief degreaser as it heats automatically, starts and stops automatically, and automatically feeds itself solvent for vapor degreasing and drying. The new modern Circo Chief degreaser sets a new pace in fast, thorough parts cleaning, producing big savings in man hours and material, and a profitable "pay-off" on every parts cleaning job. Economical to buy and to use. We would be glad to forward free literature on the Circo Chief degreaser, it's yours for the asking—write today.

CIRCO PRODUCTS CO.
2835 CHESTER AVENUE • CLEVELAND 14, OHIO



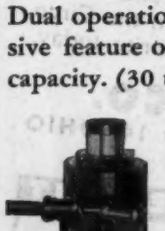
ONE HAND LIFTS 50 TONS

GREAT for lifting heavy loads • moving machinery • pressing gears, pinions or bushings •

HEIN-WERNER HYDRAULIC JACKS

are super-powerful and easy-operating

Dual operation of two speed pumps is an outstanding and exclusive feature of Hein-Werner Hydraulic Jacks of 30 and 50 tons capacity. (30 ton model is shown above).



Small illustration at left shows handle extended through both the high speed and high pressure pumps. Handle should be used this way *until* jack contacts the load.

View at the right shows handle extended through the high pressure pump only. Handle should be used this way *after* ram contacts the load . . . Tandem arrangement saves time and effort.

For full details on 3, 5, 8, 12, 20, 30 and 50 ton models, consult your industrial supply distributor, or write us.

HEIN-WERNER MOTOR PARTS CORP.
WAUKESHA, WISCONSIN

heavy angle iron, and cart is of all-welded construction. Equipped with two 24x2-in. steel spoke wheels, over-all measurements are 79 long by 30 inches high and wide. Palmer-Shile Co., 7110 West Jefferson Ave., Detroit 17.

Dielectric Heater

Called Heatmaster, dielectric heater, applicable for plastics, dehydration, sterilization, and other purposes, is announced. Compact, unit incorporates built-in electrode cage, automatic protection, heavy electrodes, and radial-fin air cooled tubes. Other features include oversized casters

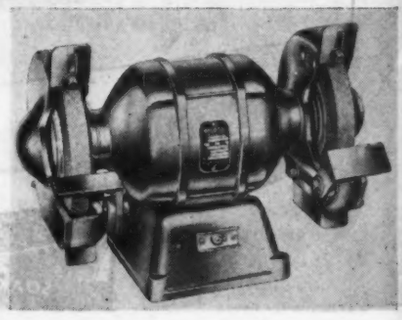
for portability, safety interlocks, industrial pushbuttons, overload relays and circuit breaker, connecting terminals, fully calibrated dials. Foot control and continuous-belt heating oven are available. Thermatron Div. of Radio Receptor Co., Inc., 251 West 19th St., New York 11.

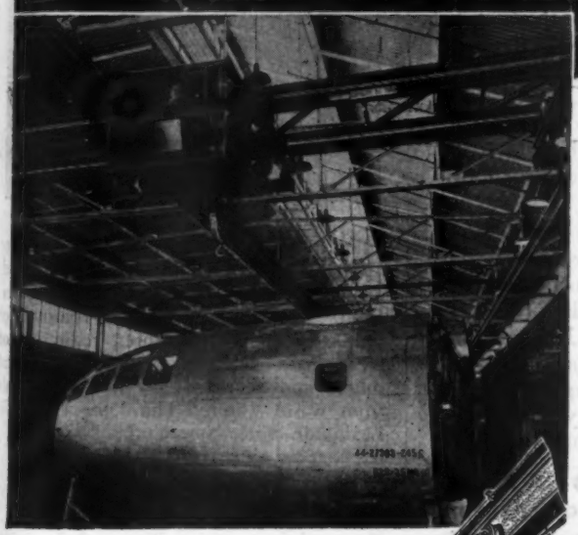
Consolidation

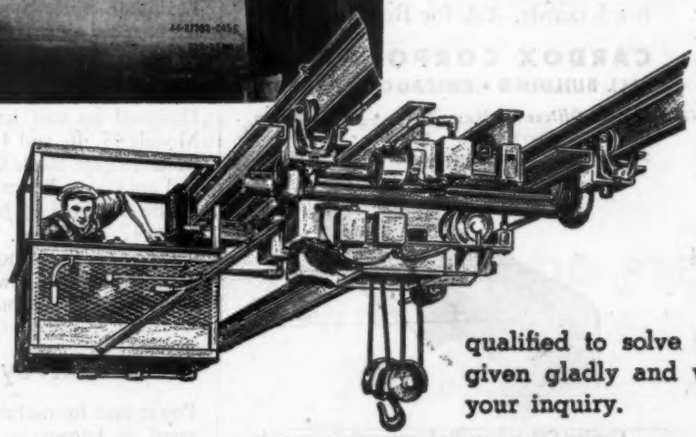
Hanlon-Waters, of Tulsa, Okla., affiliated with McAlear Manufacturing Co., Chicago, and Climax Engineering Co., Clinton, will in the future do business as the Automatic Control Division of Climax Industries, in Chicago. Hanlon-Waters manufactures welded and bolted tanks and separators; McAlear, pressure-flow liquid level temperature controls; and Climax, lock couplings.

Grinder

The 8100 series of grinders includes one model with ½-hp., 1700 r.p.m. motor, and one ¾-hp., 3400 r.p.m. unit. Aloxite 8x1-in. wheels are mounted on heavy ¾-in. arbor. End bells are tapered, providing wide clearance between wheels and motor







Top
Long-span cranes operate over multiple crane rails and run the entire length of the building.

Bottom
Two short-span cranes inter-locked as a single unit. Carrier can operate each crane individually or both as a single unit.

AMERICAN MONORAIL CRANE

Handles large center section of B-29 Wing

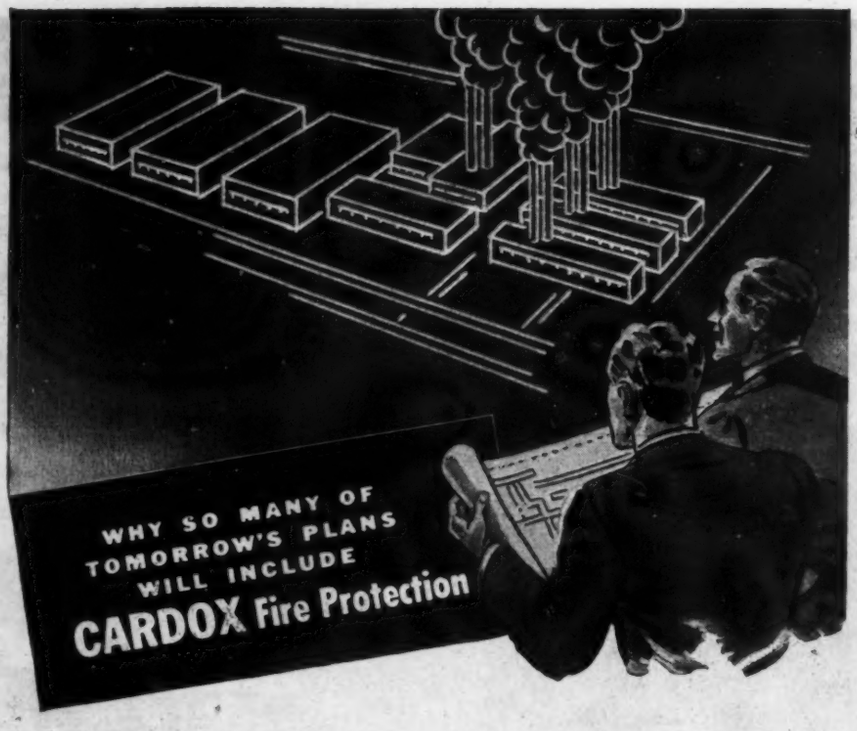
The above photograph shows a six ton center wing section of a B-29 being lifted 25 feet in the air and covering a distance of 85 yards — completely handled by crane cab operator.

This is another example of the overall application of American MonoRail cranes. This long span crane in many respects resembles an overhead railway system, all movement being controlled by the operator in the cab.

Regardless of the weight and type of overhead handling needed, American MonoRail Engineers are qualified to solve your problems. Their services are given gladly and without obligation. We invite your inquiry.

THE AMERICAN **MONORAIL** COMPANY

13114 ATHENS AVENUE • CLEVELAND 7, OHIO



Cardox Fire Extinguishing Systems and Mobile Units have been given many of America's toughest wartime fire protection assignments. In scores of vital war plants, at power stations and oil storage depots, on military and municipal airfields, CARDOX engineered applications of carbon dioxide are proving their ability to extinguish many types of indoor and outdoor fires quicker and more effectively than it has been done before.

Each Cardox System and Mobile Unit is a highly specialized fire extinguishing tool . . . exactingly engineered to do a specific job. But all Cardox applications have this one outstanding characteristic in common:

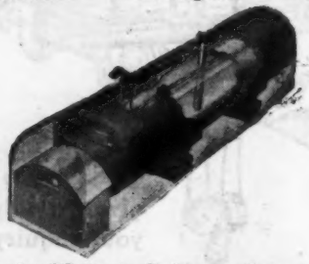
The distinctive Cardox method of control and engineered application of carbon dioxide, stored at 0° F. and 300 p.s.i. in a single storage unit containing from ¼ to 125 tons of fire-destroying Cardox CO_2 . . . enough to handle even large fires and leave an ample reserve for new emergencies!

Why Cardox CO_2 Provides Enhanced Fire Extinguishing Performance

In Cardox Systems the long recognized advantages of fire extinguishment by carbon dioxide are given enhanced performance and broadened scope of usefulness. Winter or summer—under all prevailing conditions Cardox CO_2 has uniform extinguishing characteristics. It provides high CO_2 "snow" yield for increased cooling effect upon fire zone and combustibles. This heavy CO_2 *snow* yield also provides effective projection through relatively great distance . . . even outdoors through strong winds.

Industrial executives now developing post-war plans for new plants, modernization or expansion of present facilities are invited to draw on the Cardox Research Division and Engineering Staff for practical cooperation in determining the most effective protection for your specific fire hazards. Ask for Bulletin 1175.

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS
District Offices in New York • Washington
Detroit • Cleveland • Atlanta • Pittsburgh
San Francisco • Los Angeles • Seattle



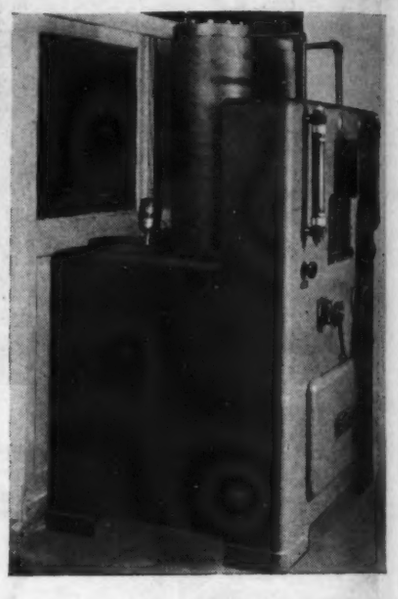
Cardox CO_2 is supplied instantly in pounds or tons from a single Storage Unit containing 500 pounds to 125 tons at controlled low temperature of 0°F and 300 p.s.i.

CARDOX
CO_2 FIRE EXTINGUISHING SYSTEMS

frames. Grinder has large tool rests and exhaust-type guards. When not connected to exhaust system, circulatory action of the wheel tends to carry dust through exhaust opening away from operator. Baldor Electric Co., 4357 Duncan Ave., St. Louis.

Water Distiller

Raw water is quickly converted into chemically pure water, meeting predetermined specifications, through use of a compact de-ionization system, according to manufacturer. Unit is claimed to deliver mineral-free water that is the chemical equivalent of distilled water in purity, and its output can be regulated to the degree of softness, purity, or mineral content required. Silica-free exchange material of mechanical and chemical stability is used, making possible long runs between regeneration. Applications include removal of simple hardness from water, reduction of bicarbonate alkalinity, reduction of total solids, and recovery of valuable metals from waste water. The Dorr Co., 570 Lexington Ave., New York 22.



Chip Trucks

Designed for easy handling and dumping, Models 45, 46, and 47 chip trucks are built from 12-gage steel, have all-welded joints, and are said to be leakproof. Types 45 and 46 are mounted on heavy steel wheels, and No. 47 has 8-in. steel roller bearing wheels. Latter truck is for use on machines having a low chip bed. W. R. Carnes Co., Madison 4, Wis.

Conveyor Drive

Power unit for motorizing conveying equipment is known as Power-Pac. It is a self-contained assembled unit in iron frame, ready to be bolted to the chassis of any piece of conveying equipment that needs to be mechanically operated. Consists of motor, driving rolls, switch speed reducers, controls, gears, and connecting mechanisms. With this device, gravity conveyor can be

In any permanent building you put up today, it's easy to reconcile present needs for ease and speed of erection with future needs for permanence and low maintenance cost. Just use decay-resistant, fire-retardant, pressure-treated wood, as in the building illustrated.

All members can be pre-framed in our shops to your blueprints, which makes erection a simple assembly job. The local labor supply can furnish all the skills and crafts needed to build the structure, which eliminates a lot of manpower difficulties. First cost is low, which keeps capital investment from being a burden later. Pressure-treatment with salts solution makes the wood fire-retardant, gives dependable defense against decay, and eliminates any need of periodical painting for protection.

Pressure-treated wood is serving and saving for users everywhere, in hundreds of varied applications. A number are illustrated in our bulletin, "Economical and Permanent Construction with Pressure Treated Wood." We will be glad to send you a copy.

KOPPERS COMPANY, INC. • WOOD PRESERVING DIVISION

PITTSBURGH 19, PA.

KOPPERS

Buy War Bonds— and Keep Them!

THE INDUSTRY THAT SERVES ALL INDUSTRY

FREE of FUNGUS....

from Seattle to Singapore

because of FIBREEN

A few years ago, a certain exporter faced the situation of leather hides arriving in China seriously damaged from fungus.

Various methods of protection were tried — until one day he hit upon FIBREEN. This important industrial paper not only prevented fungus from developing in transit — but also created other typical FIBREEN savings. Crating was eliminated, cargo space lessened, weight cut down, freight charges lowered, and claims reduced.

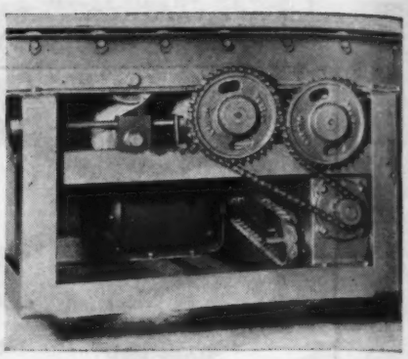
And in spite of exposure to rain, heat, salt air, humidity, and rough handling, FIBREEN was resold and used for protecting other materials stored on the China Coast.

Hundreds of manufacturers are finding in FIBREEN the answer to many of their shipping problems. It is enabling them to save time, material, freight, and handling charges, as well as give their products unmatched protection. Why not investigate its possibilities in your business.

THE SISALKRAFT CO.
205 W. WACKER DRIVE · CHICAGO 6, ILL.
NEW YORK · SAN FRANCISCO · LONDON · SYDNEY

Sisal fibre reenforcement for strength—special asphalt for water-proofness—kraft paper to make it scuff-proof—sealed by heat and under pressure to produce Fibreen.

Manufacturers of SISALKRAFT, FIBREEN, SISAL-X, SISALTAPE AND COPPER-ARMORED SISALKRAFT



motorized, allowing it to carry up grade. The unit measures 15x24x17 inches; weighs 167 pounds crated. Main pillow block housings to which are attached main drive rollers, are said to allow ample lubrication at all times. Island Equipment Corp., 101 Park Ave., New York.

Heavy-Duty Glove

Safety glove made from chrome-tanned cowhide is announced. Suitable for welding, it also can be worn for hand protection in other heavy-duty operations. A feature of the glove is its one-piece back

construction, eliminating seams that might catch sparks or molten metal. Seams are reduced to a minimum. For added strength and protection vulnerable seams are welded. American Optical Co., Southbridge, Mass.

Voltammeter

Simultaneous readings of current and voltage can be taken with Model 601

Pea-Size to Cartwheels

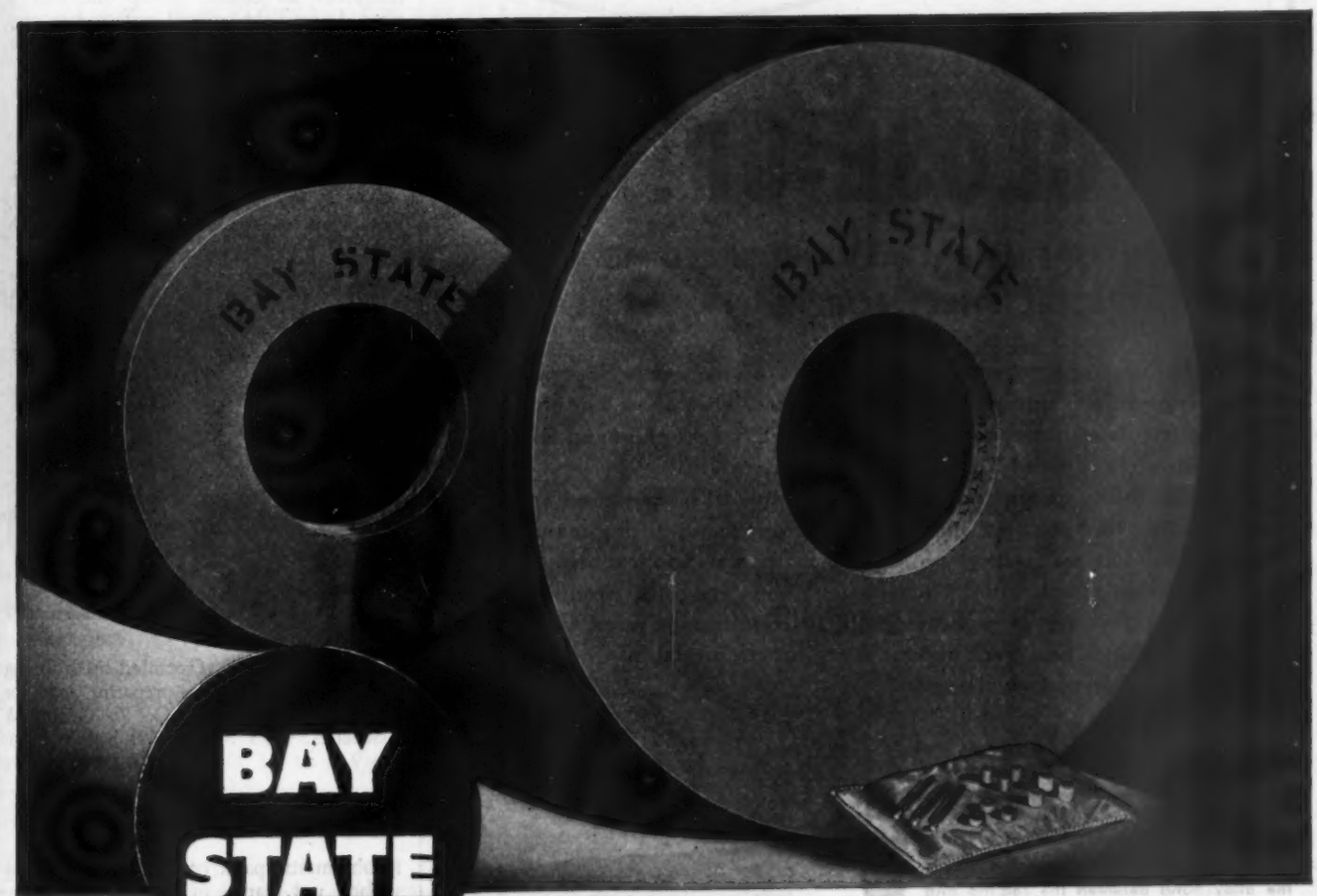
Whether you're looking for a grinding wheel the size of a small pea . . . or even smaller . . . or a 42" crankshaft wheel . . . you can find it in the Bay State line.

And whatever *specifications* you're demanding . . . in respect to bond, grain, grade, shape or structure . . . a Bay State product can be provided to fill the bill—the first time and *whenever* you require those identical specifications.

Bay State's exclusive "fractional grading", "controlled porosity" and other features make it possible to achieve greater accuracy in meeting specifications on the *original order* and duplicating them exactly on each *re-order*.

Write us for literature on the types of grinding wheels you use.

BAY STATE ABRASIVE PRODUCTS CO.
5 Union Street, Westboro, Mass.



BAY STATE

ABRASIVE PRODUCTS

Top Performance Consistently Duplicated

GRINDING WHEELS · HONING AND SUPERFINISHING STONES · PORTABLE SNAGGING WHEELS
MOUNTED WHEELS AND POINTS · CUT-OFF WHEELS · INSERTED-NUT DISCS · AND CYLINDERS

This microscopic view, magnified many times, illustrates the "toothed" surface of Superior Galvannealed steel sheets. A special heat treating process produces this ideal foundation for taking and holding paints and fine finishes.

Superior Galvannealed
TRADE MARK

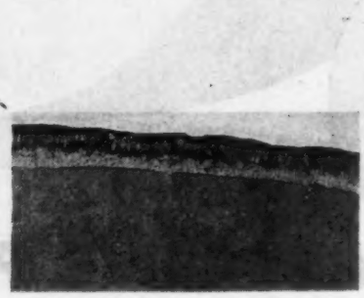
CLOSE-UP:

WHY SUPERIOR GALVANNEALED IS THE RIGHT STEEL SHEET FOR MANY USES . . .

● The micro-photographs reproduced on this page show Superior Galvannealed's unusual physical properties. They show why this highly rust-resistant, zinc-coated steel sheet "takes" paint and fine finishes readily and "holds" them longer.

The ability of Superior Galvannealed to add lasting good appearance to a product, *and* save time and expense during manufacture, has made it a favorite for many war applications. In peacetime, manufacturers use it for a wide range of products, including refrigerators, heating and air-conditioning units, washing machines, and truck bodies. Write for additional information about Superior Galvannealed.

This microscopic photograph of a cross section of Superior Galvannealed shows the alloy bond between the coating and base steel. This bond guards against rust forming under the paint, and gives extra life to the finish and sheet itself.



CONTINENTAL SUPERIOR STEEL

THE SUPERIOR SHEET STEEL COMPANY - CANTON, OHIO

PRODUCERS OF STEEL SHEETS, including SUPERIOR Galvanized Tite and Extra Tite Coat Galvanized, CHECKERCOAT, LASTIKOTE COPPERIOR (copper steel base) SUPERIOR Galvannealed, SUPER METAL, SUPERIOR Long Ternes (drawing quality), Hot Rolled Annealed, Hot Rolled Annealed Pickled, Pickled Blue, Deoxidized, and Standard Types of Galvanized Formed Roofing

DIVISION OF CONTINENTAL STEEL CORPORATION • GENERAL OFFICES, KOKOMO, INDIANA

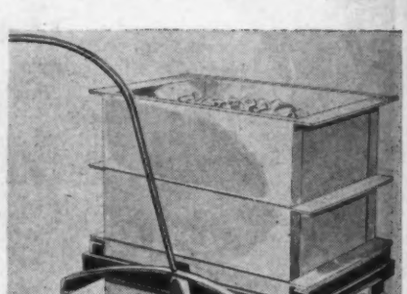
voltammeter. Ammeter measures from 0.2 to 500 amps. in 8 current ranges, from 0-1 to 0-500. Voltmeter, from 30 to 600 volts in 3 ranges—0-150, 0-300, and 0-600—can also be used on d.c. at these ranges. Inserted primary current transformer with 8-ft. secondary leads facilitates measurement of current without subjecting meter to stray magnetic fields. Meter can be located where easily read, regardless of current transformer's location. Range selector switch on panel permits quick reading of currents in all 8 ranges. Associated Research, 231 South Green St., Chicago 7.

Masonry Paint

Mason-Cote is ready-mixed exterior oil paint for coating masonry surfaces. Applied by brush or spray, it is claimed to go safely over damp masonry as well as dry, without saponification caused by alkalinity, and to be unaffected by temperature extremes. Supplied in white, it can be tinted with limeproof oil colors. Only one coat is needed over light colored surface, two over dark areas. The Wilbur & Williams Paint Corp., Park Square Bldg., Boston 16.

Box Truck

Truck, known as Tote'm, specifically designed to handle tote boxes is announced. Moves up to 3 or 4 boxes at a time with



minimum of effort. Operated by dropping and lifting the handle, preparing load for carrying or releasing. C. R. Gruber & Associates, 4873 North 41st St., Milwaukee 9.

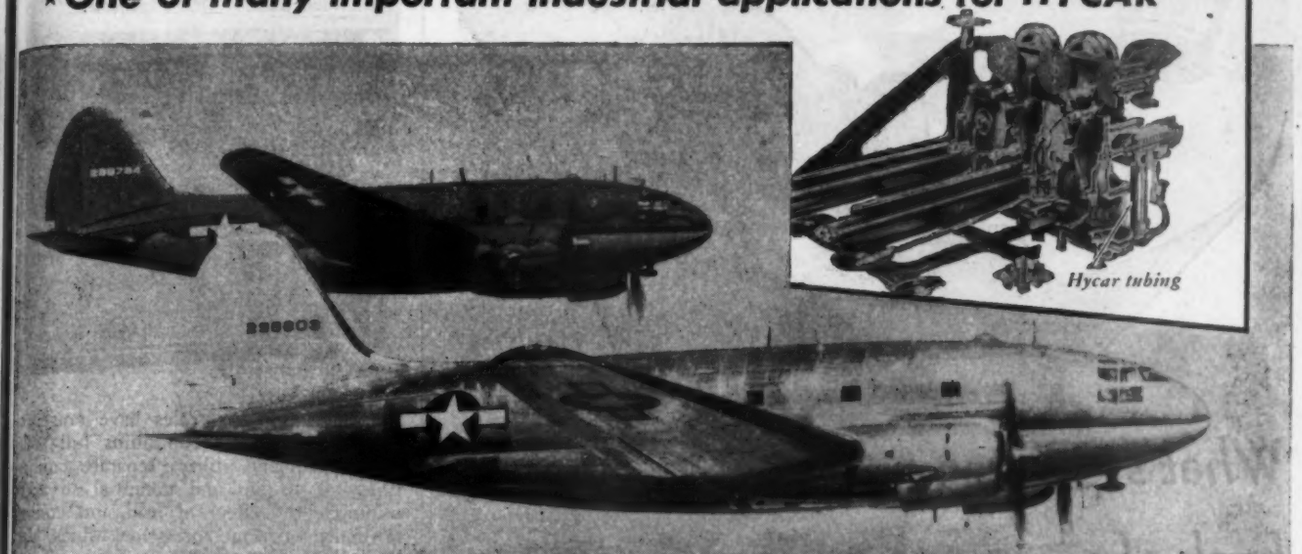
Paint for Concrete Floors

Rubbermastic paint can be applied to any surface, wet, damp, or dry, painted or unpainted, inside or outside, with no etching or preparation, manufacturer states. The coating can be used on walls, roofs, or floors of concrete, brick, stucco, paper, wood, or metal, and is simple to apply. Guaranteed Products, 1117 Crenshaw Blvd., Los Angeles.

Test Set

Milliohmmeter No. 673-F is a direct reading resistance measuring test set with linear scales that eliminate crowding of the higher values of resistance at one end of

★ *One of many important industrial applications for HYCAR*



Hycar tubing

HYCAR TUBING IN AUTOMATIC PILOT HELPS CURTISS COMMANDO OVER THE *Hump*

Hycar Parts by Ohio Rubber Co.

DESIGN engineers at Jack & Heintz wanted to get away from the use of copper for a drain tube in their famous automatic pilot. With the right resilient material they could avoid the use of fittings which require more manpower for both manufacture and assembly of the complicated units. But the hydraulic fluid used, an asphaltic base oil, caused natural rubber to disintegrate, and most synthetic rubbers to swell out of shape quickly. Any failure of the tubing in the automatic pilot could easily cause the loss of a plane like the huge Curtiss Commando that is hauling men and important supplies to every corner of the world.

Then Hycar was tested and proved that its superb oil resistance provided the answer—no deterioration, minimum swelling or shrinkage. Its excellent permanent set characteristics did away with the need for clamps to hold the tubing in place. Hycar's ability to remain practically unchanged over a wide range of temperatures—from 70 degrees below zero to 185 above, meant further that the tubing would be failure proof under all conditions. Today, two small sections of tubing made from Hycar go into every Jack & Heintz automatic pilot to help our fliers get there and back safely.

Other important properties of Hycar synthetic rubbers are shown in the box at the right. These properties may be had in *selected combinations* to meet known service conditions. Ask for parts made of Hycar. Test them in your own applications—difficult or routine. Learn for yourself that it's wise to use Hycar for long-time dependable performance. *Hycar Chemical Company, Akron 8, O.*

CHECK THESE SUPERIOR FEATURES OF HYCAR

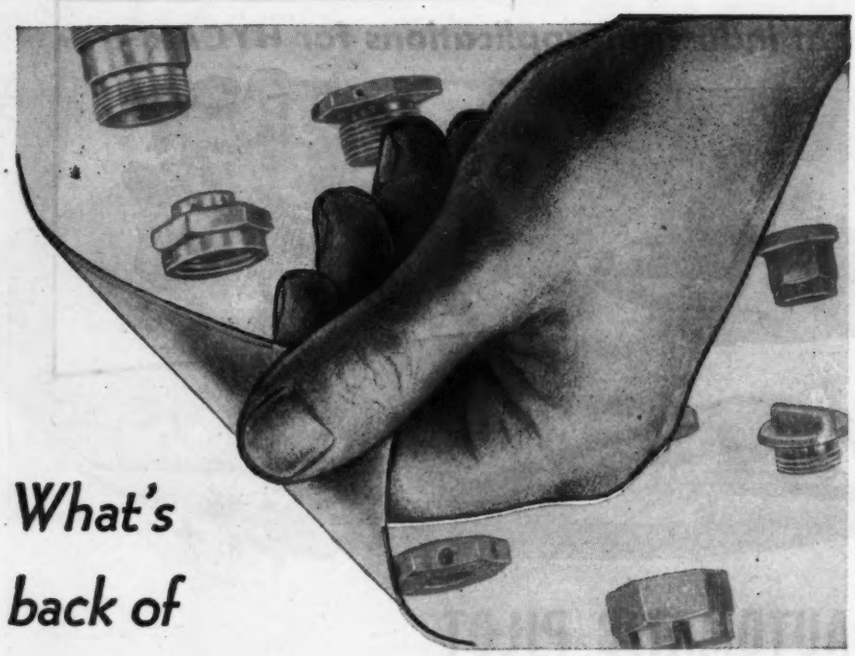
1. *EXTREME OIL RESISTANCE—insuring dimensional stability of parts.*
2. *HIGH TEMPERATURE RESISTANCE—up to 250° F. dry heat; up to 300° F. hot oil.*
3. *ABRASION RESISTANCE—50% greater than natural rubber.*
4. *MINIMUM COLD FLOW—even at elevated temperatures.*
5. *LOW TEMPERATURE FLEXIBILITY—down to —65° F.*
6. *LIGHT WEIGHT—15% to 25% lighter than many other synthetic rubbers.*
7. *AGE RESISTANCE—exceptionally resistant to checking or cracking from oxidation.*
8. *HARDNESS RANGE—compounds can be varied from extremely soft to bone hard.*
9. *NON-ADHERENT TO METAL—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)*

Hycar

Reg. U. S. Pat. Off.

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubbers



What's back of your Precision Parts Contractor?

Will he be able to meet all your requirements? For instance: a schedule that doubles or triples overnight; a change in precision finish or material that requires new manufacturing methods (grinding instead of machining); a completely new set of blueprints and specifications to be followed on short notice . . .

None of us can look into the future very far, but *we* can point to many years' experience as *precision headquarters*, during which time we have built up an organization of men, materials and machines geared to high production and rapid change-over in this exacting work.

Look to Corbin for your Precision Parts and face the future calmly!

Facilities are explained in this bulletin — which you will find in Sweet's File 4m10 for Product Designers. If you prefer that we send you a copy, please request it on your letterhead.

P-6

THE CORBIN SCREW CORPORATION
The American Hardware Corporation, Successor
NEW BRITAIN CONNECTICUT

CORBIN

See Sweet's Product Design Catalog, outline of Corbin Products and Facilities

Precision Parts

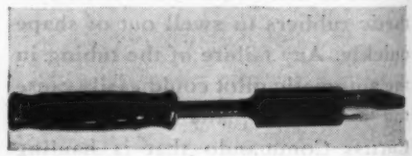
the scale. The six scales have ranges of 0-0.5-1-5-10-50 and 100 ohms full scale. The instrument utilizes separate connections for current and potential so as to minimize the effect of lead and contact resistance when mesauring low values. Uses a single No. 6 dry cell battery carried in a battery compartment built into instrument. Shallcross Mfg. Co., Collingdale, Pa.

Wax Remover

Compound is announced, for rempving old wax before refinishing floors and woodwork, as well as for taking off discolored wax before applying a fresh coat. Dissolved in warm water, it is said to remove wax, polish, oil, and dirt, without harm to hands or finish; to contain no acid, caustic, or grit; and to be nonflammable. The Savogran Co., 28 India Wharf, Boston.

Soldering Irons

Electric soldering irons that operate off batteries of trucks are presented. The irons are available in 100- or 200-watt sizes, wound for either 12 or 24 volts. Feature damage-proof, hexagon-shaped barrels that



protect element from mechanical injury, and scale-resistant element cores. Supplied with either 6- or 12-ft. cords, and plug cap or battery clips. Hexacon Electric Co., 105 W. Clay Ave., Roselle Park, N. J.

Clamp

Toggle-action clamp, having a base straight in line with the handle for flush mounting instead of flanged, is announced. Device can be fastened upright, on its side, or at any angle to meet requirements. Toggle bar can be cut, as needed. With the pressure pad located ¾ inch from end of toggle bar, a pressure of 240 pounds can be obtained with a hand pressure on the handle of 70 pounds. Known as KV-216, the

Weight Reducing Program for a world that's stepping out

You don't have to tell our fighting men what light metals are going to do . . . about making fine new jobs and better old jobs. They've eye-witnessed the light metals conquest of dead-weight that packed our bombers with crushing battle loads and gave victory-reach to our fighters. They've felt the promise of magnesium and aluminum and their alloys in the swift pace of battle and a million miracles of supply.

But peace – not war – is the real business of light metals: the easing of heavy tasks, the swifter, smoother journey, the happier, more convenient life. It's a vast new industry in leash, with remarkable resources like these:

PRODUCTION – Magnesium capacity multiplied 71 times . . . from a mere 5,000,000 lbs., pre-war, to nearly 600,000,000 lbs., postwar. Plus aluminum production of 2,395,000,000 lbs. a year.

FABRICATION – Facilities enormously expanded and then plussed by a billion dollar Government investment in light metal plants, all under option to private industry.

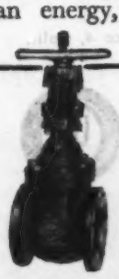
COSTS – Magnesium reduced from $5 to 20½¢ a pound and aluminum down to 15¢ a pound.

INVENTION – Amazing new uses for light metals and their alloys: railroad passenger and freight cars that should slice hauling costs; household appliances made lighter and easier to use; portable, fatigue-saving tools, and power-saving parts in heavy machinery.

What are the boundaries of an industry whose end-product is the release of human energy, the multiplying of man's pleasures? In Jenkins' opinion, they are circumscribed only by the imagination itself. Privileged to supply much of the vital valve equipment this industry has needed to spread its impatient wings, Jenkins has gained a profound respect for the vision of the light metal miracle workers – who have come to respect, in turn, the long-established industrial tradition that *"It Pays to Standardize on Jenkins"!*

Jenkins Bros., 80 White Street, New York 13; Bridgeport; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal; London, England.

LOOK FOR THIS JENKINS TRADE MARK DIAMOND MARK



JENKINS VALVES

SINCE 1864

For every service . . . in Bronze, Iron, Cast Steel and Corrosion-Resisting Alloys . . . 125 to 600 lbs. pressure.

Sold Through Industrial Distributors Everywhere

OUT OUR WAY

WHY, THIS IS SO LIGHT AN' CLEAN THAT I WOULDN'T MIND WORKING HERE MYSELF! I ALWAYS THOUGHT SHOPS WERE TERRIBLY DIRTY, OILY, GREASY PLACES!
THEY WERE, LADY-- BUT THAT WAS BEFORE SPEEDI-DRI!
"JUST LIKE HOME"
J. R. WILLIAMS
COPR. 1945 BY NEA SERVICE, INC. T. M. REG. U. S. PAT. OFF.

SPEEDI-DRI is a quadruple-threat for taking up grease and oil . . . it saves man-power, time, money, and the lives and limbs of employees.

SPEEDI-DRI is safety's magic carpet. It cuts down the danger of falls and fires on oil-slick floors. It is a granular material . . . light in color . . . with a continuous thirst for oil or grease. It blots oil and grease up out of pores, cracks, and crevices, as a blotter takes up ink.

If you're spending too much man-power and money on floor-cleaning, let us show you what SPEEDI-DRI can do for you. No gangs of trained men, no costly machines, no inflammable solvents or dangerous caustics, no back-breaking scrubbing. Just spread a carpet of SPEEDI-DRI on the dirty floors; then sweep up with an ordinary broom. Floors will be bright, bone-dry, non-skid.

For a big FREE sample, write today . . . SPEEDI-DRI for oils and greases . . . SOL-SPEEDI-DRI for coolants, syrups, acids, oils, etc.

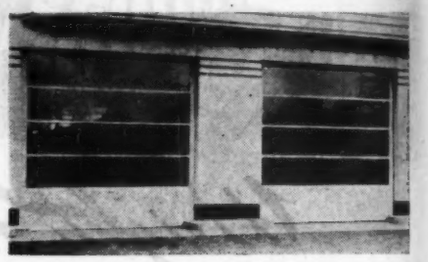
SUPPLIERS: East—Refiners Lubricating Co., New York 1, New York.
Midwest & South—Waverly Petroleum Products Co., Philadelphia 6, Pa.
West Coast—Waverly Petroleum Products Co., Russ Bldg., San Francisco 4, Calif.

SPEEDI-DRI
OIL AND GREASE ABSORBENT

clamp requires one motion to lock it on work, and a like reverse motion to release. It is 8$\frac{3}{32}$ inches high, 6$\frac{1}{2}$ inches long, and weighs 24 ounces. All parts, except toggle bar, are heat-treated. Entire clamp is cadmium plated. Knu-Vise, Inc., Detroit 6.

Overhead Door

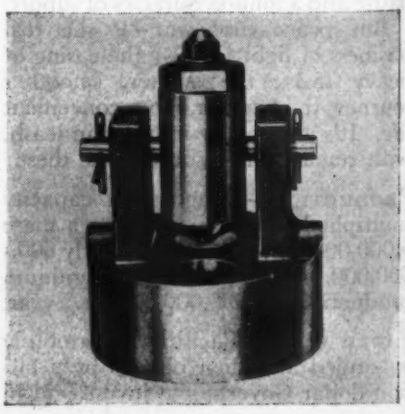
Overhead doors, known as All-Lite, feature strength, in spite of the large glass sections. The sections are reinforced, but wood divisions or muntins are eliminated. Unobstructed glass lights to a width of 12



feet may be obtained, and sections can be glazed with any of the various types of glass. Lights are set in a wood frame, which is protected by reinforcement and steel angles. Clark Door Co., Inc., 515 Hunterdon St., Newark 8, N. J.

Bearing Wear Detector

Automatic device to detect wear or failure of connecting rod and main bearing of a diesel engine is available. Consists of watchdog, or trip-lever, installed in crankcase under each connecting rod throw, a lug for each connecting rod bearing cap, a dump valve to be attached to operating



*float, *n.* 8. A file for smoothing.
— *Webster's Universal Dict.*

The Nicholson Lead Float File removes stock from such extra-soft metal as lead, babbitt and pure copper by the "floating," or "smoothing," principle. Its extra-coarse, extra-short angle, single-cut teeth are practically a series of stubby "blades" which shear away the metal rapidly under ordinary pressure. Light pressure produces the smoothing effect.

Industrial plants and machine shops use Nicholson or Black Diamond Lead Float Files on soft bearings, shims and molded parts. Plumbers and plumbing manufacturers use them on lead pipe fitting, solder joints, etc. Ship-builders use them in piping and plumbing installations requiring the use of lead or copper.

Name the job, we'll furnish the file

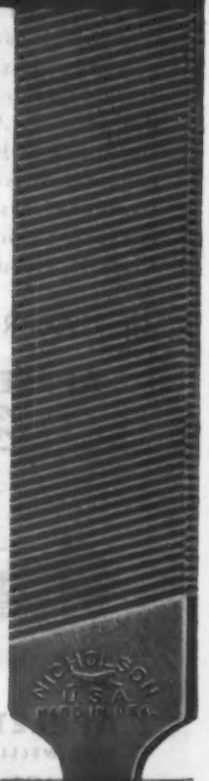
Nicholson — world's largest file manufacturer — is virtually a "clearing house" for file and filing information. Nicholson file engineers will undertake to "lick" any new filing problem involving new types of materials or special operating difficulties.

Nicholson File designs cover more than 3000 kinds, cuts and sizes of files and rasps. Most of the machines used in the cutting of Nicholson and Black Diamond Files are Nicholson-designed and Nicholson-built. Nicholson file research and pioneering are in evidence in practically every phase or stage of modern file-making progress.

For the files you need, consult your mill-supply house. For special technical information, write to us.

FREE BOOK, *"File Filosophy"* — for purchasing and production heads, shop foremen, master mechanics . . . 48 interesting, illustrated pages on kinds, use and care of files.

NICHOLSON FILE CO. • 27 ACORN STREET, PROVIDENCE 1, RHODE ISLAND
(In Canada, Port Hope, Ont.)



NICHOLSON FILES *FOR EVERY PURPOSE*

NICHOLSON U.S.A.

For Prompt Delivery

FIRST and ONLY

Explosion-Proof
FLUORESCENT LIGHTING
for Hazardous Locations

For safe, modern, efficient lighting wherever danger of explosion lurks—in oil refineries, powder mills, chemical plants, hospital operating rooms, grain elevators, and hundreds of other hazardous locations ... available *now for prompt delivery.*

Appleton Explosion-Proof Fluorescent Lighting Fixtures—skilfully designed by Appleton engineers and ruggedly built to meet all code requirements—are approved by Underwriters' Laboratories for Class I, Groups C, and D; and Class II, Groups E, F, and G.

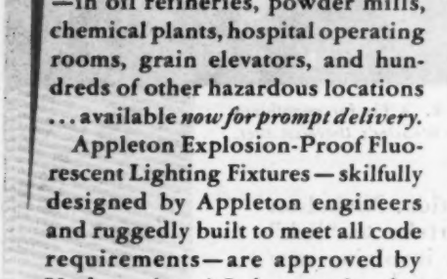
Installation is quick and easy; maintenance cost is low. All line connections are made to terminal block in junction chamber; no external seals are necessary. Takes two 48-inch, 40-watt, T-12 lamps completely enclosed in genuine Pyrex tubes. Auxiliary fittings, shown below, simplify installation.

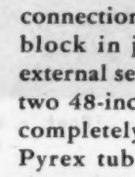
Improve production with better light in the hazardous locations in your plant—install Appleton Explosion-Proof Fluorescent Lighting Equipment. Write today!

Sold Through Wholesalers

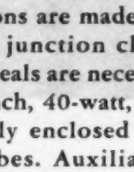
APPROVED BY UNDERWRITERS' LABORATORIES

APPLETON FLUORESCENT EQUIPMENT IS *Complete*

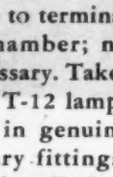




"GRU" Series Explosion-Proof Flanged Ceiling Unilet with Fixture Canopy.



Type "LSH" Ceiling Support for Blind or Dummy End—Spans Line Conduit.



Type "UNY" Explosion-Proof Union Connectors—Fit End Castings of Fixture, Facilitate Mounting.

APPLETON ELECTRIC COMPANY
1715 WELLINGTON AVENUE · CHICAGO 13, ILLINOIS
14 Branch Offices and 7 Resident Representatives in All Principal Markets

APPLETON ELECTRIC PRODUCTS

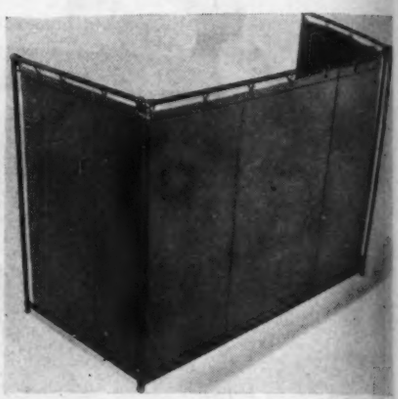
APPLETON

CONDUIT FITTINGS · OUTLET AND SWITCH BOXES · EXPLOSION-PROOF FITTINGS · REELITES

mechanism of standard hydraulic governor, a control box containing air pressure reducing valve and tell-tale light, and copper tubing for connecting the parts. The system shuts down engine if a main bearing goes out, and protects engine in case of broken bearing caps, cap bolts, or connecting rods. Paxton Diesel Engineering Co., Omaha, Neb.

Welding Curtain

Lightweight tubular framework, with welding curtains attached, is announced for protection against interior, temporary hazards of welding operations. Frames can be folded over for storage or for portability. Curtains are equipped with grommets and



clip-type hooks for removing and changing. Universal Safety Equipment Co., 700 South California Ave., Chicago 12.

Damper

Double damper smoke control, called Stackmaster, is made in various sizes. The exact design is determined after a study of the requirements has been made. Adjusts smoke stack to daily weather conditions to eliminate excess smoke, reduce

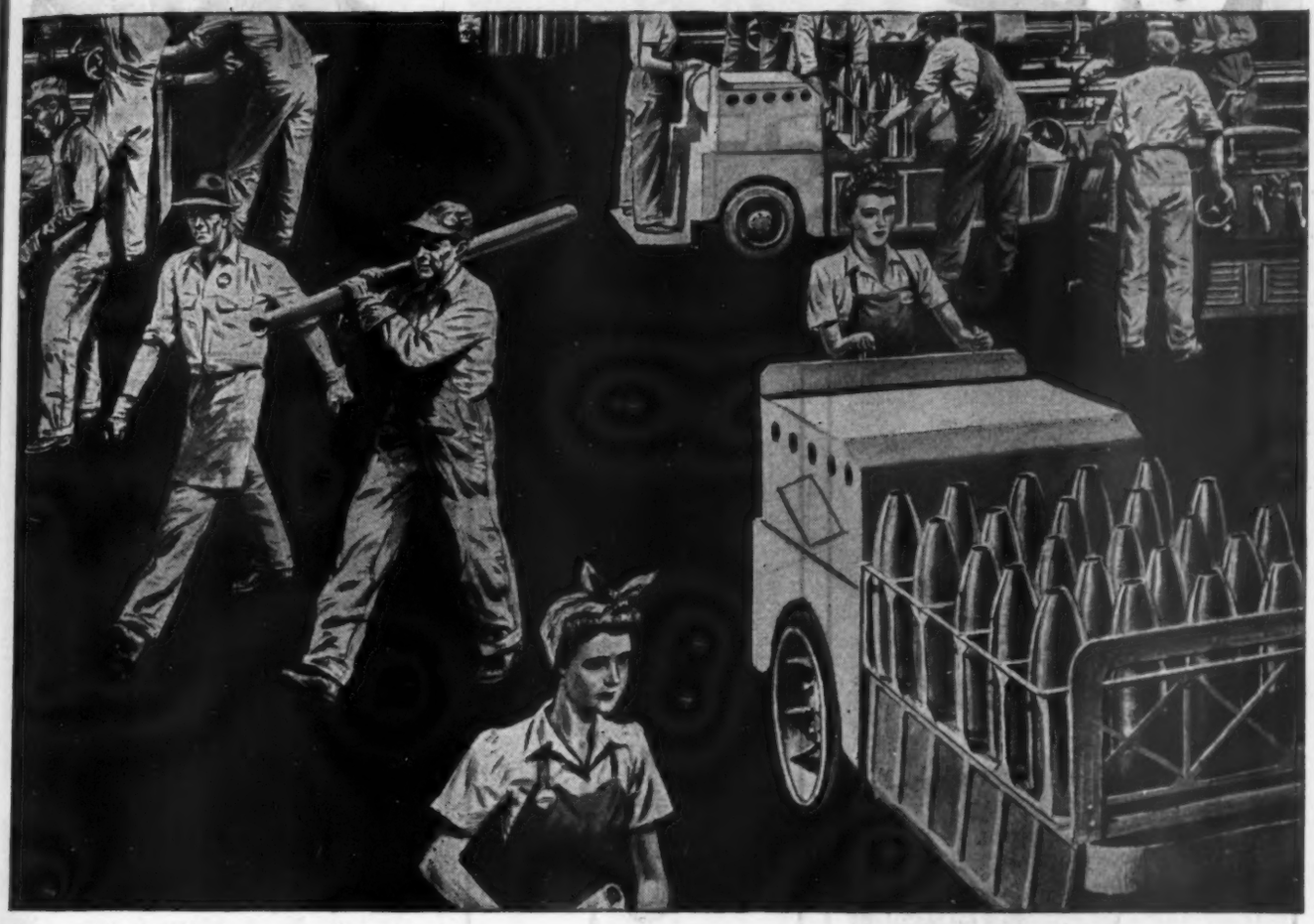
excess stack temperatures, maintain uniform volume of draft, and stop combustion fuel losses. Installed with either electric, hydraulic, or pneumatic control system to meet conditions where excess smoke and combustion losses prevail. Campbell Engineering Co., Appleton, Wis.

Rotary Pump

Low-capacity, close-coupled rotary pump is announced for pumping water or other liquids under high pressure. With capacities ranging from ¼ to 8 g.p.m., pump operates on vacuums up to 26 inches, with

For New Floors or Resurfacing... choose the floor that

IMPROVES WITH TRAFFIC



Here's a paradox in flooring...

A floor that actually improves with increased traffic.

How is that possible?

It's due to the resilient, shock absorbing qualities of Flintkote Mastic Floors that actually cause the surface to respond favorably to the kneading action of heavy truck traffic.

And... either by hand-trowel or by power-float... it's easy to apply.

OVER OLD CONCRETE FLOORS Flintkote Mastic is economical for complete resurfacing and can be installed quickly with a minimum of production tie-ups.

ON STEEL FLOORS . . . . . . you get double duty from your mastic carpet.

Flintkote Mastic protects steel flooring from corrosion and wear.

It is a quiet, non-skid surface that cuts traffic noise to a minimum, and eliminates the hazard of slippery steel floors.

RESURFACING WOOD FLOORS with Flintkote Mastic gives you a long wearing, protective surface that carries traffic quietly and efficiently.

It is dustless, and will not splinter.

Be sure your wood floor is structurally sound... then protect your property by laying a tough, permanent, protective Flintkote Mastic Floor.

★ ★ ★

But remember... whether for new flooring or for resurfacing... a mastic floor gives you these important advantages:

Long life under heavy traffic
Minimum of traffic noise
Resilient, dustless, comfortable
Easily and economically installed
Will not ignite or sustain combustion

Write us for complete information.

FLINTKOTE INDUSTRIAL PRODUCTS

THE FLINTKOTE COMPANY · 30 Rockefeller Plaza, New York 20, N. Y.

Industrial Products Division

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CM HOISTS

68 Years of experience really means something

COMET light weight electric hoist. Capacities from ⅛th to 1 ton.

METEOR heavy-duty electric hoist. Capacities from ½ ton and up.

CYCLONE 12 bearing high speed hand hoist. Capacities from ¼th ton and up.

Since 1876 Chisholm-Moore has been providing industry with many types of overhead materials handling equipment. These years of experience combined with "service-thinking" engineering skill are reflected in the operating efficiency, durability, economy and safety features of all CM materials handling equipment...Hand Chain Hoists, Electric Hoists, Monorail Trolleys, Traveling Cranes, CM Puller (for horizontal pulling) and other CM equipment are fully illustrated and described in Catalog 1944. You'll find the information most helpful. Write us today for a copy.

CHISHOLM-MOORE HOIST CORPORATION

(Affiliated with Columbus-McKinnon Chain Corporation)

GENERAL OFFICES AND FACTORIES: 130 Fremont Ave., TONAWANDA, N. Y.

SALES OFFICES: New York, Chicago and Cleveland

water up to 500-lb. pressure, and for oils or other viscous liquids up to 1000 pounds. Operates at full motor speed at 1750 r.p.m. on lighter liquids, or 1200 r.p.m. on heavier. Bump Pump Co., La Crosse, Wis.

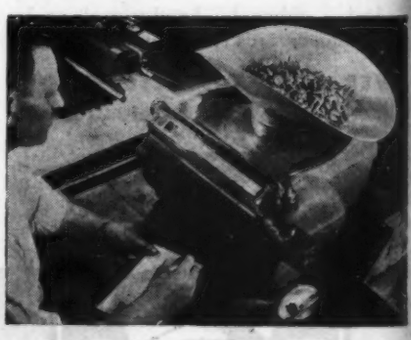
Electronic Rectifier

Epco magnetic chuck rectifier is an industrial electronic control to convert 110-volt a.c. to 110-volt d.c. Embodies wave rectification by electronic tubes mounted

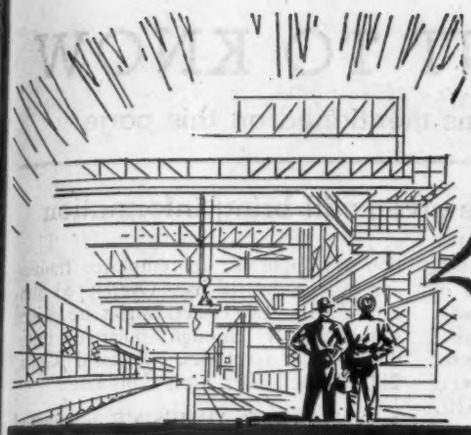
on shockproof bases, precision-built transformers, condensers, and replaceable protection fuse. Model 2 delivers 2 amps. (approximately 250 watts) at 110 volts d.c., and No. 6 delivers 6 amps. (700 watts) at 110 volts d.c. Davis & Murphy, 5252 Broadway, Chicago 40.

Counting Scale

Scale to count parts by direct reading is announced. Instead of counting parts one at a time, or using measuring methods, parts can be placed on counting scale, and result is registered on a dial. Unit is



suitable for solving inventory problems resulting from contract terminations, according to manufacturer. J. H. Keeney & Co., Inc., 6610 South Ashland Ave., Chicago.



THINGS ARE LOOKING
BRIGHTER

For looks and for life, you can't beat *Aluminum Paint*

One stroke with a brush and aluminum paint will brighten the darkest surface . . . and it will stay bright a long time. Won't become discolored by fumes. Will give you long-lasting protection against rust.

You can use aluminum paint to advantage on all kinds of interior surfaces . . . metal, wood, concrete, masonry. It is your best bet by far, where heat and moisture conditions are bad.

ALUMINUM COMPANY OF AMERICA
1983 Gulf Building, Pittsburgh 19, Pa.

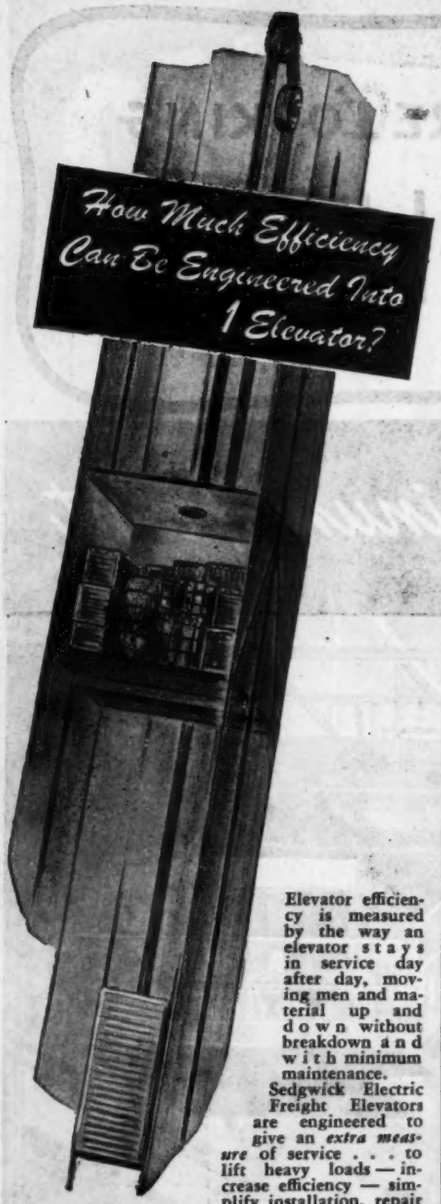
This means 99+ . . . assures better Aluminum Paint

When you buy aluminum paint insist on getting Alcoa Albron pigment, made from 99+% pure aluminum. Purity is vital for best results. Also important is a good manufacturer's name behind the paint.

ALCOA ALUMINUM

ALBRON

ALCOA ALBRON PASTE IS MADE UNDER PATENTS OF THE METALS DISINTEGRATING COMPANY, INC.



Elevator efficiency is measured by the way an elevator stays in service day after day, moving men and material up and down without breakdown and with minimum maintenance. Sedgwick Electric Freight Elevators are engineered to give an *extra measure* of service . . . to lift heavy loads — increase efficiency — simplify installation, repair and maintenance. And they are designed with many features for safe operation:

1. **Electro-magnetic brakes**
2. **Centrifugal speed governors**
3. **Special heavy duty motors**
4. **Self-aligning motor mountings**

Sedgwick makes five *standard* freight elevators with capacities from 2500 to 8000 lbs. But Sedgwick designs and manufactures elevators to lift any load. Fact is, today, on many aircraft carriers, fighting planes are lifted from hangar deck to flight deck on Sedgwick elevators — capacities, 85,000 lbs. and more.

Sedgwick engineers are ready *now* to help solve your vertical "man" handling and materials handling problems. Tell us about them.

Sedgwick Electric Elevators and Dumb Waiters are available only on suitable priority and delivery is subject to prior commitments to the Navy, Coast Guard, Merchant Marine and Army. Hand power elevators and dumb waiters are available without priority.

Sedgwick
MACHINE WORKS
138 W. 15th St., New York 11, N.Y.
ELEVATORS SPECIAL LIFTS
HOISTS DUMB WAITERS

YOU WANT TO KNOW

more about the items mentioned on this page

Letters to the addresses given will bring information

• SURFACE FINISHES of metal, paper, and other materials may be measured or compared with standards at 100-dia. magnification by taking impression on plastic "Faxfilm," and showing through a projector or comparator. No developing or printing process involved. Rex D. McDill, 5109 Mayfield Rd., Cleveland 21.

• CORROSION PROTECTION for galvanizing is provided by dipping in "Iridite Galvon." Dye colors may be added. Rheem Research Products, Inc., Standard Oil Building, Baltimore 2.

• LIQUID INSULATION penetrates electric wire coils to protect from water short-circuiting and corrosion. Used for motors, dynamos, ignition systems, and other electrical equipment. Effective under tests, submerged, for as long as two years. U. S. Industrial Chemicals, Inc., 60 East 42nd St., New York.

• GOVERNMENTAL CONTROLS of private industry, in effect during war, are discussed in relation to reconversion in *War Controls and Reconversion*. Copies available from Kohler Co., Kohler, Wis.

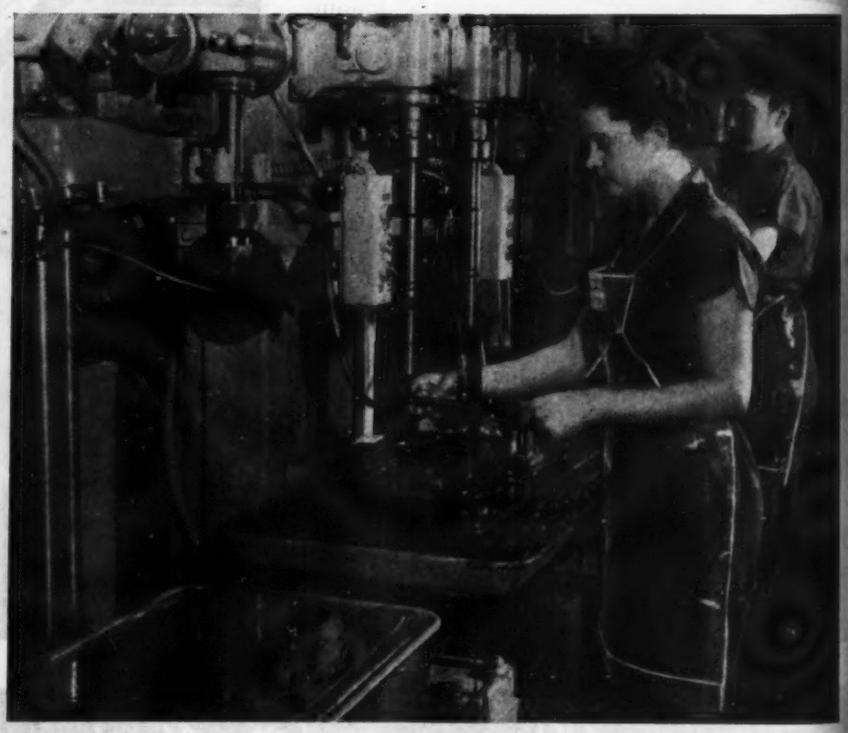
• THREE-DIMENSIONAL PICTURES for direct viewing or lantern-slide projection are applicable for employee training and other industrial use. Overlapped films exposed from two camera angles are viewed simultaneously through polaroid three-dimensional spectacles. Polaroid Corp., 211 Massachusetts Ave., Cambridge.

• SYNTHETIC ADHESIVE is effective on all types of materials. Called "Pliobond." Strength of its bond, versatility, and ease of application—either hot or cold—are among its claimed advantages. Goodyear Tire & Rubber Co., Akron.

• THERMOPLASTIC, high in electrical insulating properties, and resistant to heat distortion to 236 degrees, is now in volume production under name of "Styramic HT." Monsanto Chemical Co., St. Louis 4.

• KEEPING SENIORITY RECORDS is described by case histories of methods used by numerous companies, in booklet *Management Controller No. 709*. Copies obtainable at local office or from Systems and Methods Research Department, Remington Rand, Inc., 465 Washington St., Buffalo 5.

• ELECTRICIAN APPRENTICESHIP STANDARDS, revised version, are embodied in 32-page booklet available from



Greasy machines and benches are no hazard to the clothes of workers who wear compar transparent aprons. Compar clothing is fabricated from a rubber-like substance, which is claimed to be tough, resistant to abrasion, and entirely impervious to oil and all organic solvents, and to many that are inorganic. Gloves, aprons, smocks, caps, and so on, are obtainable. Resistoflex Corp., Belleville, N. J.

STAMPING-OUT BEARING-FAILURES

SUN LUBRICANT . . . Stops Bearing-Failures on Stamping-Presses, Brings Down Costs, Cuts Lubrication Time by 75%

A manufacturer of stampings for aircraft and radios ran into frequent bearing-failures on big blanking and forming presses. A nationally known brand of cup-grease was being used, but was being squeezed out of the bearings.

Frequent refilling of the grease-cups was called for, but still could not protect the bearings. Maintenance-costs were high.

An adhesive pressure-grease, specially made by Sun Oil to withstand heavy loads and to stay put in open bearings, was recommended by a Sun Engineer. With this grease, two years went by without a single bearing-failure. Steady, uninterrupted production resulted . . . costs nose-dived . . . and 75% of the man-hours formerly spent on lubricating were eliminated.

Steady production is one of the big dividends paid by careful selection and use of petroleum products. In hundreds of plants . . . manufacturing, rubber, paper, textile, chemical, steel, and other industries . . . Sun Engineers and Sun products are helping management to keep machines going for record periods. If you are interested in getting maximum output at the lowest overall maintenance-cost, call the Sun man near you, or write . . .

SUN OIL COMPANY • ***Philadelphia 3, Pa.***

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SUN INDUSTRIAL PRODUCTS

OILS FOR AMERICAN INDUSTRY

INDUSTRIAL "GOOD HOUSEKEEPING" *Pays Dividends!*

. . . A CONVEYOR-COORDINATED PLANT IS USUALLY A CLEAN, EFFICIENT PLANT

ORDER and cleanliness — freedom from congestion—smooth flowing channels for production — safety for workers — these are important additional advantages gained from conveyors — they contribute substantial added savings to time and handling-cost economies conveyors provide.

The steps you take now — the investment in conveyors that you make at this time to coordinate your production — eliminate disorder and confusion — cut your handling costs — will not only pay immediate dividends but yield an even greater return in the days of competitive production to come.

Knowing how to apply power and gravity conveyors to best advantage is equally as important as building them well. An experience record of more than 40 years, serving all classes of industry and business, qualifies Standard Conveyor to be of service to you.

Write for valuable reference book "Conveyors by Standard," Catalog No. FM75.

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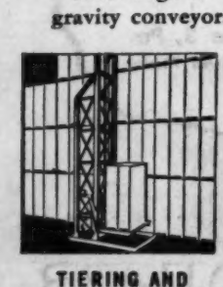


TIERING AND LIFTING MACHINES

PORTABLE PILERS

SPIRAL CHUTES

PNEUMATIC TUBE SYSTEMS

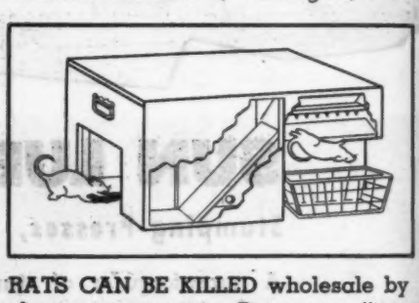
Apprentice-Training Service, Bureau of Training, War Manpower Commission, Washington 25.

• LABELS MAY BE FASTENED and waterproofed by "Resin Adhesive Q3605," a solvent-free synthetic resin emulsion. Applicable on "V" board, wood, and black or galvanized iron. National Adhesives, 270 Madison Ave., New York 16.

• INSPECTION of castings and welds for flaws can be made by horseshoe magnets. Metal sprinklings, spread on upper surface, collect at point of any minute internal or external cracks when magnet is placed on lower surface. Dings Magnetic Separator Co., 509 E. Smith St., Milwaukee 7.

• STANDING ORDERS for Nurses in Industry is a booklet that sets forth a uniform set of orders which serve as a guide to plant nurses. These "orders," however, are subject to approval by the plant physician and must bear his signature before becoming effective. Limited number of copies available on request. American Mutual Liability Co., 142 Berkeley St., Boston 16.

• A HANDBOOK on Wage Incentive Plans, compiled by the Management Consultant Division of WPB, discusses development of plans, wage incentives in general, types of plans, and results. Appendix shows relationship between wages, productivity, and costs. Price is 10 cents, and copies may be obtained from Superintendent of Documents, Washington, D. C.

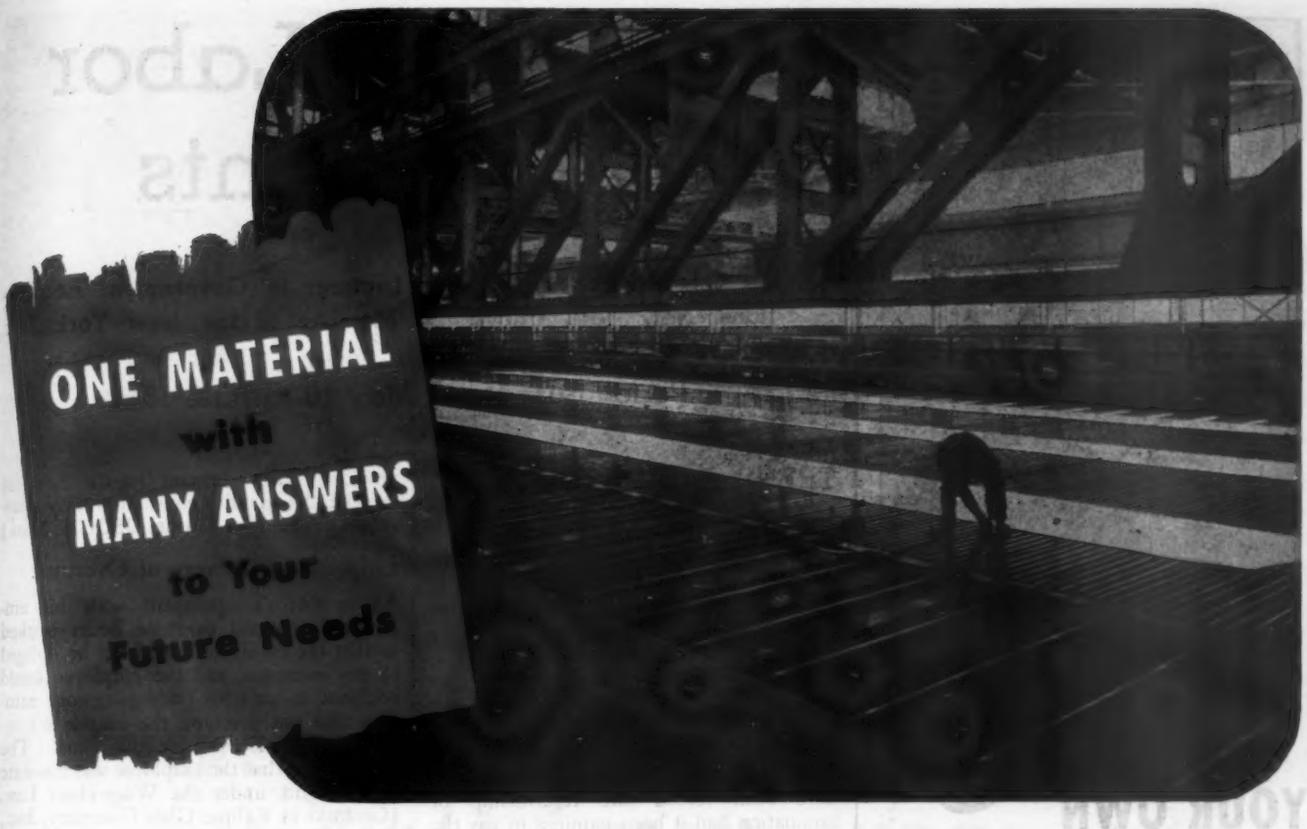


RATS CAN BE KILLED wholesale by electronic rat trap. Rat enters "tunnel," whose doors close behind him. He climbs ramp to execution chamber, is killed by electrodes that pass the shock through his body, falls to basket below—automatically opening the door of the tunnel, all ready for next victim. For rent only. Electronic Traps, Inc., 7 Norfolk Place, Rochester 6, N. Y.

NEW FILMS: *The Fight for the Sky*, 16- and 35-mm. motion picture with sound; running time, 20 minutes. A Seventh War Loan enterprise. Apply to Motion Picture & Special Events Section, War Finance Division, Treasury Department, Washington, D. C.

Maintaining the American Standard deals with methods of maintaining cleanliness and sanitation, and with materials for cleaning produced by film's sponsor. R. M. Hollingshead Corp., Camden, N. J.

Selecting the Right Thermosetting Molding Material, and Product Design and Molding Technique for Thermosetting Plastics. Both 16-mm. with sound. Princeton Film Center, Princeton, N. J.



It's Steel...from the Republic Flat Rolled Line

Right now, your future needs may be somewhat vague, but you can be sure that the world's most versatile material—Steel—will provide the answers to most of your demands. And you can get Steel in its wide range of qualities from *one source*—the Republic Flat Rolled Line.

The complete line of Republic Products includes analyses ranging from plain carbon to stainless steel—forms from light-gauge strip to 90-inch wide sheets—in all commercial finishes. If the material you want must fabricate easier and faster, even in deep drawing—must resist heat, cold, abrasion or rust—or meet many other product or manufacturing requirements, just remember one name—Republic.

The Republic Flat Rolled Line is the result of a huge reservoir of experience in steel research, engineering and processing, accumulated by a leader in the metals industry. And a feature of its uniformly high quality is the absolute centralized control of manufacturing by Republic, starting with the processing of the ore.

When the time comes to select materials for product or maintenance requirements, the Republic Flat Rolled Line will give you the combination of features you want.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Bldg., New York 17, N. Y.

Trade Names to Remember

TONCAN IRON
(resists rust and corrosion)

ENDURO STAINLESS STEEL
(corrosion- and heat-resisting)

ALDECOR — COR-TEN
REPUBLIC DOUBLE STRENGTH
(weight-saving, high strength steels)

TONCAN ENAMELING IRON
(easy to fabricate and enamel)

ELECTRO PAINTLOK
ELECTRO ZINCBOND
ELECTRO NEVAPEEL
(take paint readily—hold it)

TAYLOR ROOFING TERNES
(proved by 134 years' use)

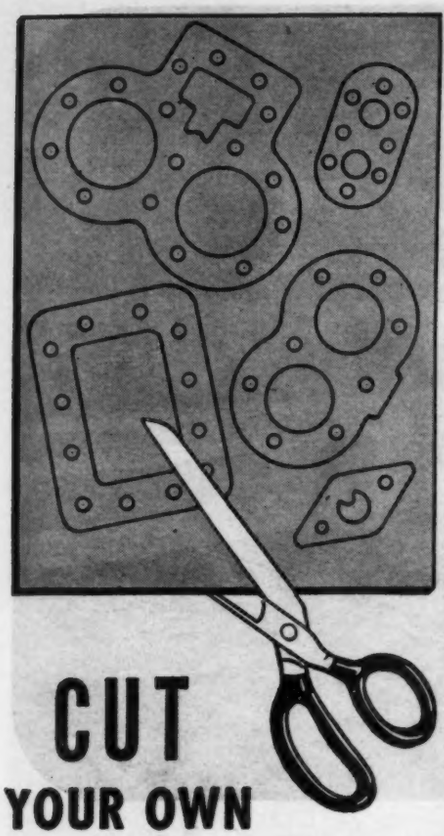
REPUBLIC SILICON STEEL
(high-performance electrical steel)

EX-L-ITE TIN PLATE
(uniform high quality)

Republic

FLAT ROLLED PRODUCTS

SHEETS: Hot and cold rolled—carbon, copper-bearing, alloy and stainless steel—Toncan Iron—electrical, enameling, culvert, galvanized, galvannealed, electrolytic, paint, roofing, terne, oven lining, bonderized. ● STRIP: Hot and cold rolled—coils and cut lengths—electrical, carbon, alloy and stainless steel—Toncan Iron. ● PLATES: Universal, sheared mill plates—carbon, alloy and stainless steel—Toncan Iron—light armor. ● TIN PLATE: Coke and electrolytic—black plate and bonderized black plate—lacquered and enamel stock.



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YOUR OWN
TYGON GASKETS
for
CORROSION-RESISTANT
PRESSURE-TIGHT SEALS

Every industrial maintenance department should carry on hand a supply of Tygon gasketing stocks. Ideal for forming pressure-tight seals in connection with handling acids, alkalies, fresh or salt water, alcohol, oil, grease or gasoline.

This flexible, chemically inert plastic resembles rubber in appearance, feel and physical properties. Unlike rubber it will not get brittle with age, will remain flexible, resilient, even at low temperatures. Suitable for gasketing use at temperatures as high as 150° F.

We can furnish Tygon sheets, tape, ribbons, strip or extruded rings from which you can easily cut your own gaskets. Or in quantities, we can furnish the complete gasket made to your specifications.

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Since 1865 • Akron, Ohio

Significant Labor Developments

BENJAMIN WERNE, Lecturer in Government Regulations, New York University, Member of the New York Bar

Period Surveyed: May 10 to June 10

TREND INDICATORS

Homework Ban Enforced

INDICATIVE of the vigorous enforcement of the homework ban in embroidery firms is the issuance of injunctions against 14 firms for violation of the ban.

Waiver Held Binding

A waiver agreement by which an employer was released from paying wages due under the Wage-Hour Law was held binding where the public utility involved would have been forced into receivership or liquidation had it been required to pay the total amount of wages due its employees. The court deemed such circumstance to be sufficiently exceptional as to warrant such decision. (Torres Romero vs. American Railroad Company of Puerto Rico, USDC P. R.)

Travel Time

In line with the Tennessee Coal decision, the U. S. Supreme Court ruled that time spent by underground coal miners in traveling to and from the mine portal is compensable as working time under the Wage-Hour Law. The court found that elements present in the Tennessee case were also present in the instant case—namely the physical exertion involved in the travel, the employer's control of the travel, and the benefit of the travel to the employer. The universal custom in the industry, and collective bargaining agreements recognizing travel time as time not worked, were held immaterial factors, since the Act contemplates uniform wage policy regardless of existing contracts. (Jewell Ridge Coal Corporation vs. United Mine Workers, U. S. Sup. Ct.)

Overtime Plan Invalid

A wage contract guaranteeing employees working a fluctuating work week a weekly salary for six day's work (deducting one-sixth of the week's guarantee for each day lost) with no compensation given for hours worked in excess of 40 a week, were deemed invalid on the ground that the employer maintained false records. As recorded, the employee's hourly rate and his overtime compensation were determined at the end of the week in such fashion that they equaled the sum paid the employee under the lump-sum arrangement. The court explained that this instance was different from the Belo plan, since the latter provided for a constant regular rate for overtime basis and a constant weekly guarantee. (Walling vs. Castle, USDC S. Miss.)

Employee's Recovery of Overtime

An employee's agreement with his employer to conceal overtime hours worked so that the employer would not be obliged to pay overtime, and the employee could continue to earn his prior piecework earnings, did not preclude the employee's recovery of back overtime due him. The court found that the employee was unaware of his rights under the Wage-Hour Law. (Gosinski vs. Eclipse Glass Company, Inc., Conn. Ct. Com. Pls.)

Held Exempt

Ruling that the entire process of manufacturing milk to cheddar cheese, in one case, and cream to butter, in another, as first processing, a state supreme court ruled that the operation was completely exempt under the Wage-Hour Law. The court explained that had the plant pasteurized milk for resale as such, then that process would have been the first processing; however, where, as in this instance, the product was not pasteurized milk, but rather cheddar cheese and butter, the complete process constituted the first process. (Sugar Creek Creamery Company vs. Walker, Ark. Sup. Ct.)

Held Under the Act

Employees engaged in waiting on persons wishing to rent motor vehicles from a multi-state enterprise engaged in renting vehicles to business firms and individuals. The court, upsetting the Wage-Hour Administrator's classification of "drivurself" firms as service establishments, declared that the employee's work was necessary to the operation of interstate commerce, inasmuch as the company disregarded state lines in renting out the vehicles. (Barish vs. Hertz Drivurself Stations, Inc., USDC E. Pa.)

Employees of a laundry company which obtained 80 percent of its business from another company which was regularly engaged in interstate commerce to the extent of 5 percent of its business. (Phillips vs. Star Overall Dry Cleaning Laundry Company, CCA-2)

Held Not Under the Act

Employees engaged in the construction of a dock structure, intended for the exclu-

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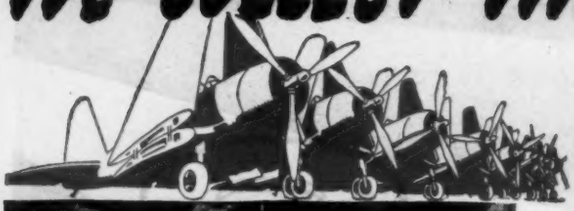

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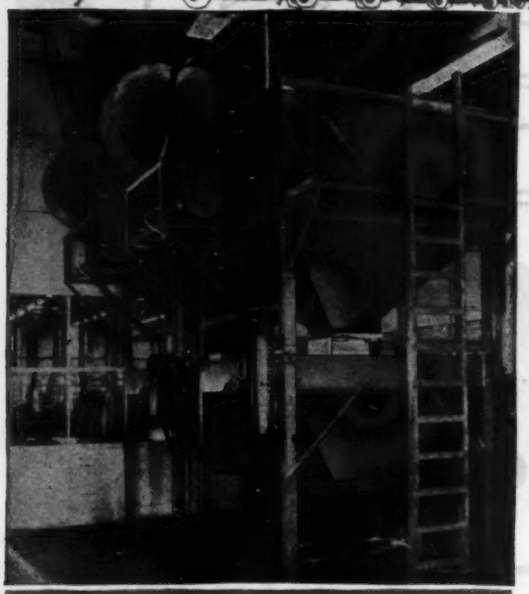

Here is an interesting application of AAF equipment to materials collection which does not directly involve a dust hazard. Airmat Dust Arresters segregate two different types of aluminum aloy chips for salvage in the propeller division of a large aircraft manufacturer. Since blades made of both alloys are worked on the same machines it was necessary to install parallel collecting systems, either one or both of which may be operated as required.

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Below—Aluminum Alloy Chip Conveying Systems for 10 Propeller Profilers. Parallel exhaust systems to separate Airmat Dustboxes permit segregation of two alloys.

AAF

AMERICAN AIR FILTER COMPANY INC.

361 Central Avenue, Louisville 8, Ky.—In Canada, Darling Bros., Ltd., Montreal, P. Q.

sive use of the U. S. Navy, inasmuch as the dock may not be used by any commercial vessels in the ordinary course of commerce. (Ritch vs. Puget Sound Bridge & Dredging Company, Inc., USDC W. Wash.)

Held Under Walsh-Healey Act

Employees of an oil refining company engaged in cleaning and repairing stills, since their work is necessary to the manufacture of products supplied to the government under contracts. (Lion Oil Refining Co.)

WAR LABOR BOARD

**Increases by Industries in Reconversion*

Employers in reconversion are now permitted to effect wage schedules without prior WLB approval. These schedules, however, must be filed with the appropriate board agency for a subsequent review. If the agency finds, on review, that the schedule contravenes the policies of stabilization, adjustments will be ordered, but not retroactively unless the parties so agree. The board has set up the following guides to aid employers establishing these schedules:

1. Where the job content of key jobs is the same despite complete conversion, the rates should remain the same and act as basis for other job rates.

2. Where the job content of all jobs is changed, the rates of the new jobs should be based on the level of prevailing wages paid for comparable jobs in the industry or area.

3. Where the job content of civilian production jobs is different from war jobs being performed in other parts of the plant, the rates of the new job should be so fixed as to provide for a balance with the rates for the jobs remaining on war production.

**Rates for Partial Reconversion*

A company which was partially reconverted to civilian production was told by a RWLB to compensate its employees working on peacetime jobs at their pre-conversion average incentive earnings until permanent peacetime rates, based on a new job evaluation study, could be established. The company's suggestion that a rate which had been paid during transition to war production be used, was denied, since the latter rate was 5 cents below the employees' pre-war earnings and would be tantamount to an unauthorizable wage reduction. (Newark Stove Company, RWLB-V)

**Reconversion Wage Policy Inapplicable*

WLB's recently announced reconversion wage policy is not applicable to the building and construction industry, inasmuch as the job content of the various operations

---

* In this and the following classification items marked with an asterisk also are considered to be trend indicators.

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of the construction industry is not altered by a change from war to peacetime work.

* *Wage Rates Approved*

On the finding that the medical center of a plant and the plant itself exchanged personnel, that numerous job classifications were identical, and that rates in the two units were identical until the institution of the Southern California Aircraft Industry schedule, a RWLB approved the company's request to pay the same rates to its medical center employees as was established under the industry schedule for the aircraft industry's technical and office salaried personnel. (Aircraft Workers' Medical Plan, RWLB-X)

* *Increase Directed Without Approval*

No approval need be obtained for increasing rates up to a minimum of 55 cents an hour, provided the adjustment does not furnish a basis for price ceiling relief or a bar to justifiable price reductions.

* *Increase Under Contract Enforced*

Despite the employer's contention that an increase provided for in an individual employment contract was invalid because the contract had never been approved by WLB, a state supreme court ordered the employer to comply with the provision of the contract and grant the increase, because the contract had been entered into when the employer had fewer than eight workers and was, therefore, exempt from wage stabilization controls. (Kaline vs. Gary, Jr. Inc., N. Y. Sup. Ct.)

* *Increase to Minimum Going Rate Permitted*

Regional boards are not compelled, but merely permitted, to raise wages up to the minimum of going wage rates in dispute cases; the latter serve only as upper limits to which increases may be made. WLB affirmed a RWLB award to bring the rates of a small oil refinery up to the minimum going rates for the industry in the area. (Pan-American Petroleum Corporation, WLB)

* *Plant Rates Equalized*

Despite the fact that two plants of a public utility company were located in different labor market areas, and that separate going wage rates for public utility jobs were set for each area, a RWLB directed the utility to establish the same rates for substantially similar jobs in the two plants. The board based its decision on the company's previous plea before the NLRB that both plants be considered as one unit for bargaining purposes. The board, therefore, reasoned that the company was a highly integrated one, and that the two sets of rates should be equalized. (Public Service Company, RWLB-IX).

* *Revision of Bracket Minimums Forbidden*

WLB has forbidden its agencies to revise existing bracket minimums or set new bracket minimums on the basis of the new substandard rate of 55 cents. While

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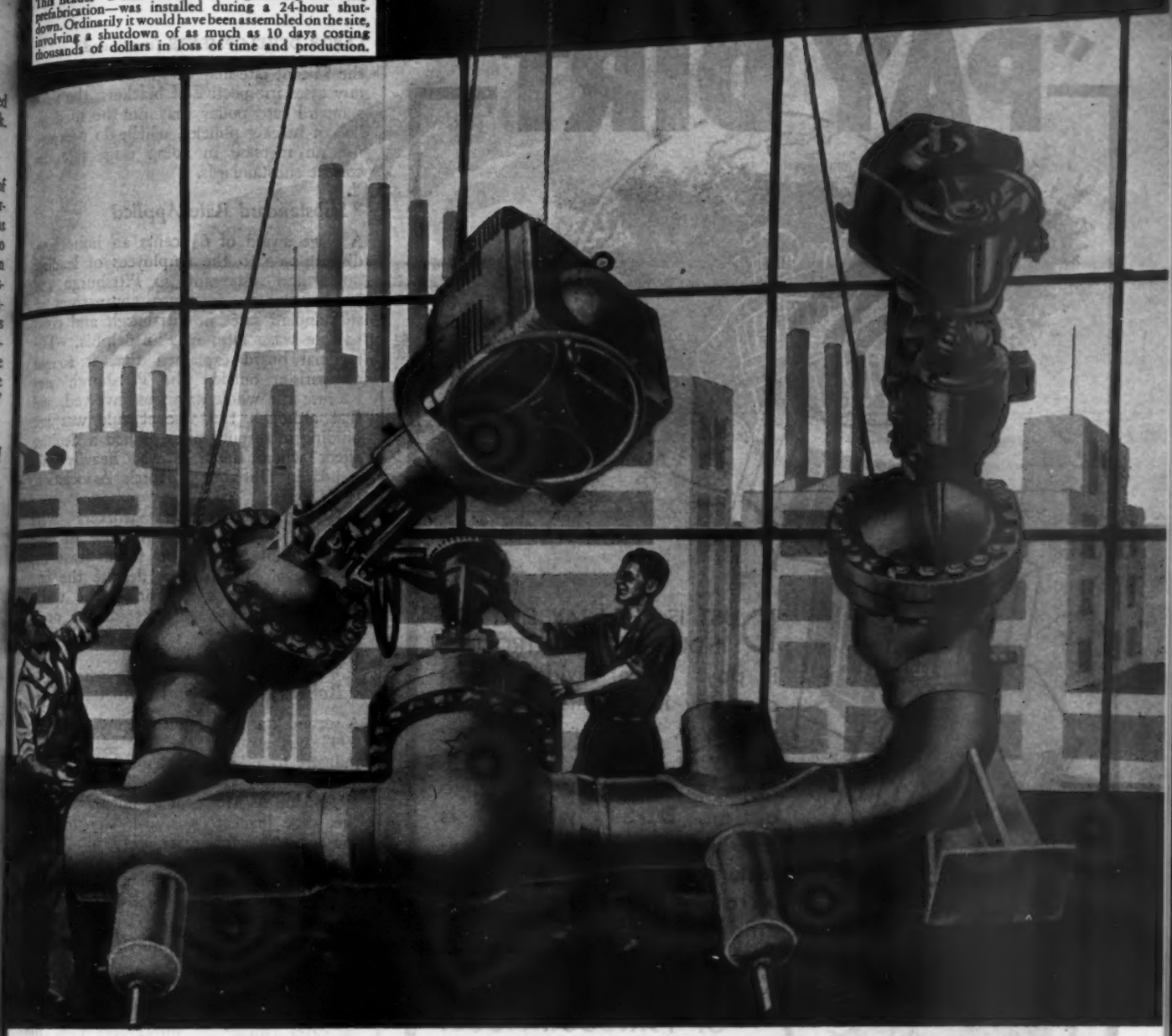

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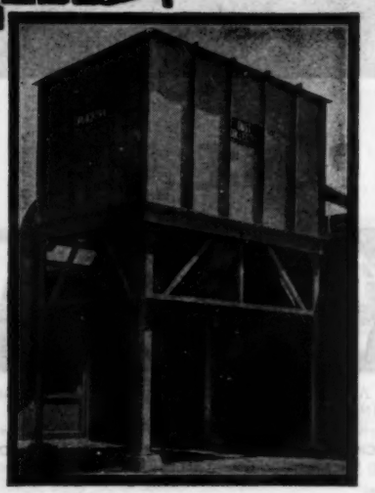

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LABOR DEVELOPMENTS *(continued)*

the 55-cent rate may be approved in voluntary cases irrespective of brackets, the substandard rate policy may not be used in lieu of bracket policies, which do not permit an increase in going wage rates to correct substandards.

* *Substandard Rate Applied*

A wage award of 6½ cents an hour in a dispute case to the employees of leading hotels and restaurants in Pittsburgh was justified by an inter-area comparison of substandard rates in Pittsburgh and comparable wage rates in Philadelphia. The regional board explained that it sought comparison outside the Pittsburgh area because the whole area was involved, and that although the 55-cent rule was not binding in dispute cases, it had a decisive effect where the rate was heavily substandard. (Pittsburgh Hotels Association, RWLB-III)

Government cafeteria workers were awarded a 3½-cent wage increase to raise each employee's rate up to at least the 55-cent substandard rate, despite the fact that such increase will bring the wages above the going wage rates for the occupations in the area. (Welfare & Recreational Association, RWLB-III)

* *Relief in "Rare and Unusual" Case*

A second "rare and unusual" increase since 1943 was awarded the Michigan lumber industry to aid the companies in retaining and recruiting labor. On the findings of WPB and WMC that an increase above the wage brackets was necessary to help the industry achieve its 1945 production quotas, the regional board awarded an additional 10 cents per hour. (Michigan Lumber Companies, RWLB-XI)

* *Retroactive Pay Ordered Despite Waiver*

Despite the fact that the union had waived its right to nine months' retroactive wage increases (under an impression that the employer was not liable for the retroactive pay because of pending receivership), a RWLB, in an effort to correct interplant inequities, directed the company to pay the wage increases retroactive to the date when an association of the company's competitors effectuated an identical increase. (820 North Michigan Corporation, RWLB-VI)

* *Back Pay*

Employees owed unpaid retroactive wage increases have a valid claim against the assets of a dissolved corporation. (Kern County Dehydrating Company, WLB)

* *Overtime Ordered*

Payment of time and one-half for all hours worked in excess of 40 a week, and for the sixth consecutive day of the work week, was ordered by a RWLB with provision for computation of each of the first five days of the week as work days if absences were excusable. The board included in its order a list of excusable reasons for absences such as: Lack of work, shutdown, proved illness, death in the im-

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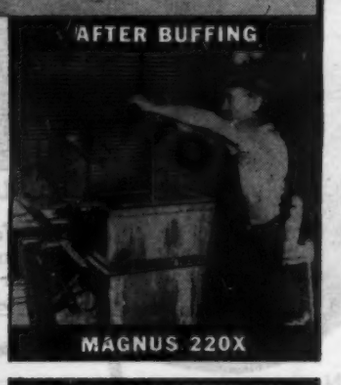

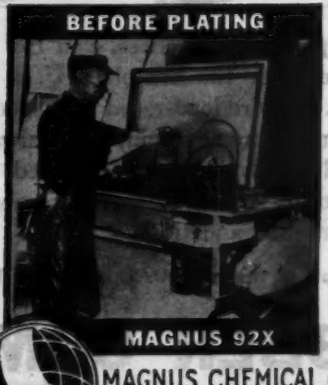

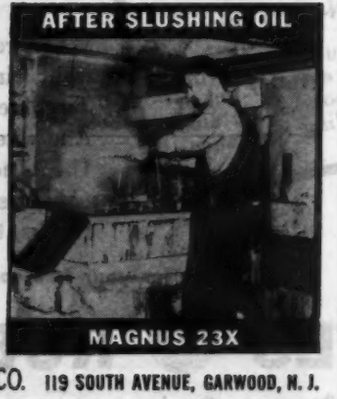

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LABOR DEVELOPMENTS *(continued)*

mediate family. (International Stacey Corporation, RWLB-V)

** Overtime Award*

Adopting a weekly basis for awarding overtime rather than a daily basis, a RWLB denied a union's request for time and one-half for hours worked in excess of nine a day. The board, however, granted time and one-half after 45 hours weekly. (American Stores Co., RWLB-III)

** Holiday Pay*

In directing a company to pay its employees at straight-time rates for six holidays not worked on the basis that 40 percent of the employees in the industry and area received such pay, WLB lays down its first ruling on what constitutes "substantial" practice to warrant the extension of certain "fringe increases." The board pointed out that a rigid majority test would prove impractical. It added, however, that the 40 percent figure used in the present case was not to be considered as a definite percentage for application in future cases, but served merely to affirm a regional board's authority to consider less than a majority of employees in an industry and area as a "practice." (Babcock & Wilcox Company, RWLB-II)

** Straight Time for Holidays Not Worked*

Despite lack of supporting industry-area practice, a RWLB directed the payment of straight time for two holidays not worked. The board explained that in dispute cases it would consider each case on its own merits, taking into consideration the industry-area practice, recent changes in vacation practice, the aggregate of other monetary adjustments being directed in the case, and the "unanimity of the panel's recommendations." In the present case, the board had been most strongly influenced by the fact that the union's monetary demands had been denied and that the panel's unanimous opinion was for two paid holidays. (Armstrong Cork Company, RWLB-III)

** Premium Award Disallowed*

The director of Economic Stabilization disallowed a WLB award of a 7½-cent premium for all hours worked between 7 p.m. and 7 a.m. on the ground that it was unstabilizing. The director explained that no distinction was made between overtime and straight-time hours worked during the night and between second and third shift hours, that overtime should be compensated for by regular overtime pay but that hours worked on the second shift should not be compensated for at the awarded premium since the latter was too high under stabilization rules. The board had originally made the award irrespective of industry-area practice, since the case involved employees producing 40 percent of product consumed. (California Processors & Growers, Inc., Dir. of Eco. Stabilization)

** Rules of Automatic Progression*

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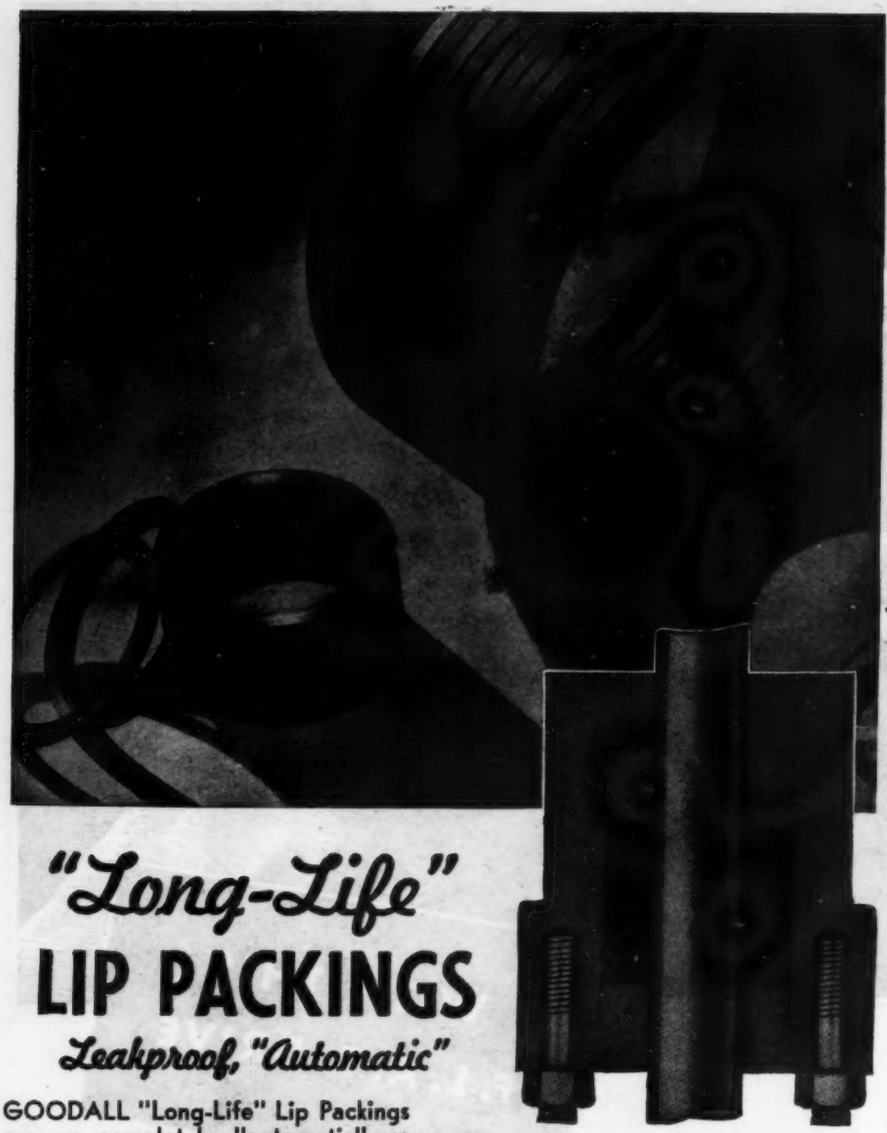

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GOODALL "Long-Life" Lip Packings are as completely "automatic" as possible, with pressures developed in the mechanical unit directly governing the sealing action of the rings. Being sensitive to pressure changes, they do not require gland pressure. If properly installed, subsequent adjustment to compensate for pressure changes should not be necessary. Channels formed between rings serve as reservoirs for lubrication.

"Long-Life" Packings are furnished in ring form only, solid or split, in all rod and stuffing box sizes. Each set consists of one bottom adapter ring and a sufficient number of pressure rings to provide the required depth.

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LABOR DEVELOPMENTS *(continued)*

board, WLB announced that the approved formula provides for progression from minimum to maximum of a rate range as follows:

1. Joint determination of "objective standards" to be used as a basis for progression.

2. Joint determination of frequency of periodic review of employee's performance in view of these standards.

3. Disputes arising over application of standards are to be subject to the grievance machinery of the parties' contract.

4. Merit adjustments in an employee's hourly wage rate are to be made at steps of 5 cents an hour or one-half of an employee's rate range classification.

5. The objective performance standards agreed upon are to be applied retroactively to the retroactive effective date, subject to offsets by merit increases granted since that date.

* *Decrease for Demerit Permitted*

A RWLB approved a job evaluation plan providing for demerit decreases not to exceed 10 cents an hour in any one year for employees failing to meet the performance standards set forth in the plan. The board pointed out the employee's rate would not be decreased below the minimum of his rate range. It is unlikely that such plans will be ordered in dispute cases. (Warwick Company, RWLB-I)

* *Bonus Part of Basic Wage*

Contrary to NWLB's policy, a RWLB directed the incorporation of a cost-of-living bonus into the basic wages. The NWLB had reasoned that a cost-of-living bonus was an emergency measure and should, therefore, be distinct from the wage structure so that it could be easily eliminated when the emergency disappears. The regional board, however, likened such bonus to a Little Steel adjustment which must be included in the wage structure. (United Drug Company, RWLB-I)

* *Recruitment Bonus Discretionary*

The NWLB recently announced that its policy does not preclude the approval of recruitment bonuses by regional war labor boards. Accordingly, the board remanded a case to the appropriate regional board for reconsideration because the latter board had denied a recruitment bonus to the company in question, on an erroneous belief that the national board barred such approval. Whether or not such bonuses may be approved now lies within the discretion of regional boards and commissions. (Aluminum Company of America, RWLB-VII)

* *Incentive Commission Ordered*

Initiation at the beginning of the war of special incentive commissions to salesmen for obtaining business from war production procurement agents was ordered continued, despite the fact that there was no longer any need for the salesmen to get in touch with the war production representatives. The board, in so determining, pointed out that the business these men had obtained

HOW RCA TUBES INCREASED OUTPUT OF PLASTIC PARTS 400%

Electronic Preheating Cut Rejects, Shortened Operational Time, Simplified Molding of Intricate Plastic Parts at Kurz-Kasch

This 2000-watt RCA electronic generator can preheat one pound of plastic molding material to 275°F in about 40 seconds

IN July 1943, Kurz-Kasch, Dayton, Ohio, plastics molder, was called upon to deliver a large quantity of high-priority molded pieces within a few weeks. Because the pieces were difficult to mold, rejects due to poor preheating ran as high as 65%; production of the required quantity seemed impossible to achieve in the time available.

Electronic Preheating Tried: Tests were made with electronic preheating, and the method proved successful. In actual practice, electronic preheating cut overall operational time by 50%. Thus, disregarding rejects, production would have been doubled. But, the reduction in rejects brought the total usable output to *5 times its former level*—a 400% increase!

Job Details: The material used in this molding job was Melmac No. 592. The preforms weighed 370 grams, measured 4 inches across and 1½ inches in thickness. A large number of metal inserts were included. Electronic preheating time was only 45 to 50 seconds.

How Electronic Heating Works: By means of RCA electron tubes, 60-cycle commercial power is changed to power at a frequency of several million cycles per second. When this power is passed through the preform it generates heat *within the preform.*

Advantages of Electronic Preheating of Plastics: Heat is instantaneous and uniform throughout the preform pellet. When the power is shut off, heating stops immediately; there is no residual heat to coast temperatures beyond desired limits. With thermo-setting plastics, which set with the application of high temperatures, the quick heating possible with electronic heat permits greater workability and results in fewer rejects. Production-line techniques can be employed, cutting processing time to a few minutes—or even seconds.

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still brought profit to the company. (Industrial Tape Corporation, W.L.B.)

Similarly denied were an employer's request to reduce the commission on sales subject to renegotiation and a proposal to reduce commission rate because of a planned reorganization which was expected to cause an increase in unit sales. In the former, the board pointed out that the decrease was unjustifiable under WLB policy; in the latter, the board explained that a decrease could not be approved on the basis of an "expected" event. (Gardner Denver Company, WLB; Frankel Clothing Company, WLB)

* *Incentive Ordered*

Computation of incentive pay on a daily rather than weekly basis was ordered by a RWLB. The companies' contention that such computation would lead to loafing on the job after a desired number of units had been produced, and that excess production of one day would be "banked" against subpar production of the next day, were deemed by the board curative through the maintenance of accurate production control records. (Carborundum Company, RWLB-II; Precision Castings Company, Inc., RWLB-II)

* *Layoff Provisions*

A company's request to modify the present contract provisions on layoff so as to take into account ability as well as seniority was rejected by a RWLB. The union contended that such consideration of ability would lead to endless discussions of relative ability of employees. (American Cystoscope Makers, Inc., RWLB-II)

* *Layoff Pay Ordered*

Three regional war labor boards directed the payment of layoff pay where no advance notice was given the employees involved. One board provided for 7 days' notice or pay; another for 40 days' notice or 20 days' pay; the last, for two weeks' wages in lieu of two weeks' notice. All but one of the boards made provision for employer relief if the layoff was caused by unforeseen events. (Peavey Metal Arts, RWLB-IV; American Cystoscope Makers, Inc., RWLB-II; Goodyear Synthetic Rubber Corporation, RWLB-X)

* *Prerequisite to Veteran's Reinstatement*

Union membership was made a condition of the reinstatement of veterans under a contract which the RWLB approved. The contract, which was drawn up and approved because the company refused to make counter-proposals to the union's demands, provided for continuation of a union shop plus preferential hiring and a veteran's clause which stipulated that returning veterans must accept the contract terms as a condition of employment. (Erdette Hosiery Mills, Inc., RWLB-III)

WLB Denied Jurisdiction

Because WLB lacks jurisdiction over the company in question, a federal district court issued a temporary injunction against the company's manager restraining him

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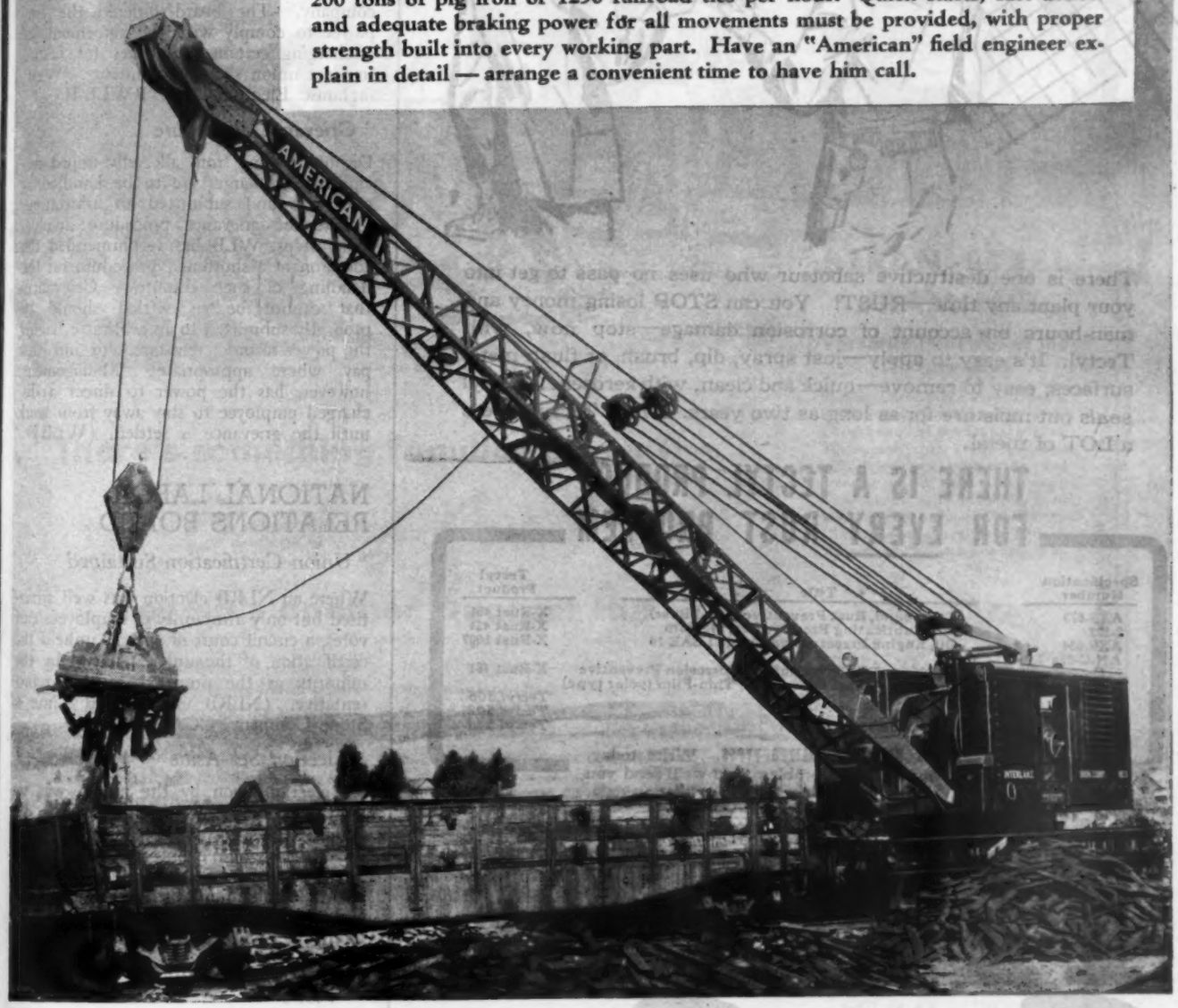

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from appearing before a regional board panel or submitting company books and records to the panel. The board assumed jurisdiction of the company, a restaurant, because it had advertised during a strike that it fed defense workers in the area. (S. & W. Cafeteria of Tennessee vs. Aird, USDC E. Tenn.)

* *Union Shop Provision Sustained*

Where a memorandum agreement, containing a union shop provision, was drawn up by a recognized official of the company, and accredited union representatives and the company complied with the agreement in the past, a RWLB held it to be binding upon the employer despite the fact that it had never been signed by the company. The board ordered the employer to comply with the agreement by discharging certain employees for failure to meet union shop requirements. (Westinghouse Electric Corp., RWLB-II)

* *Grievance Procedure*

Disputes arising from allegedly unjust disciplinary discharges are to be handled as grievances and submitted to arbitration. Where the grievance procedure involves many steps, WLB has recommended the adoption of a shortened procedure for the handling of such disputes. Grievances that cannot be so settled should be promptly submitted to an arbitrator having the power to order reinstatement and back pay where appropriate. Management, however, has the power to direct a discharged employee to stay away from work until the grievance is settled. (WLB)

NATIONAL LABOR RELATIONS BOARD

* *Union Certification Sustained*

Where an NLRB election was well advertised but only a minority of employees cast votes, a circuit court of appeals upheld the certification of the union selected by the minority as the proper barganing representative. (NLRB vs. Standard Lime & Stone Company, CCA-4)

* *Election Set Aside*

An election, won by the union, was set aside by the NYLRB because of the distribution of a purportedly official ballot of the board. The ballot so circulated differed from the official one in that it bore an "x" in the union's box, indicating a vote for the union. (National Transportation Company, NYLRB)

* *No Union Expulsion for Political Views*

A union may not expel an individual from its membership because of opposing political views, if the member's job depends on his continued membership in the union. The union has a maintenance-of-membership contract with the employer and the latter was called on to discharge the employee, a union steward, after he had been expelled from the union for political reasons. The court stated that, although the union was within its rights in demoting

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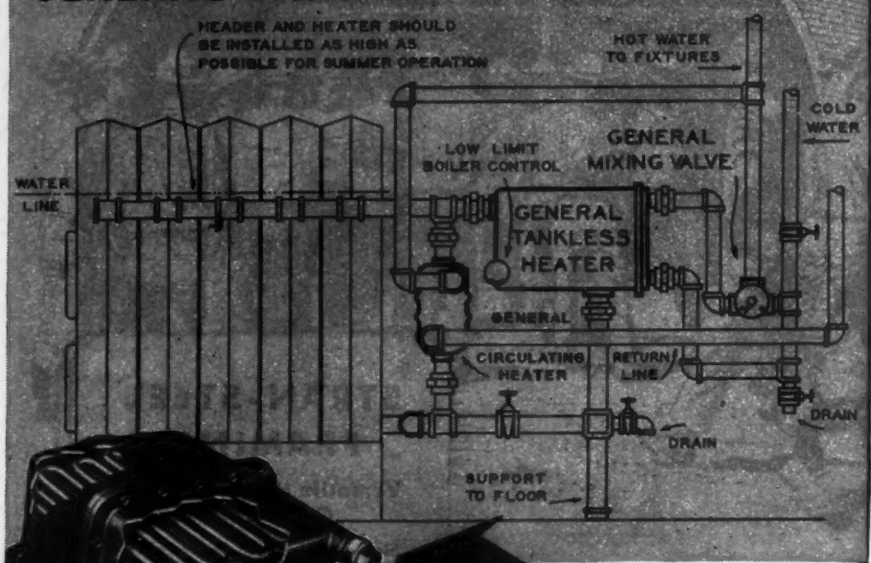

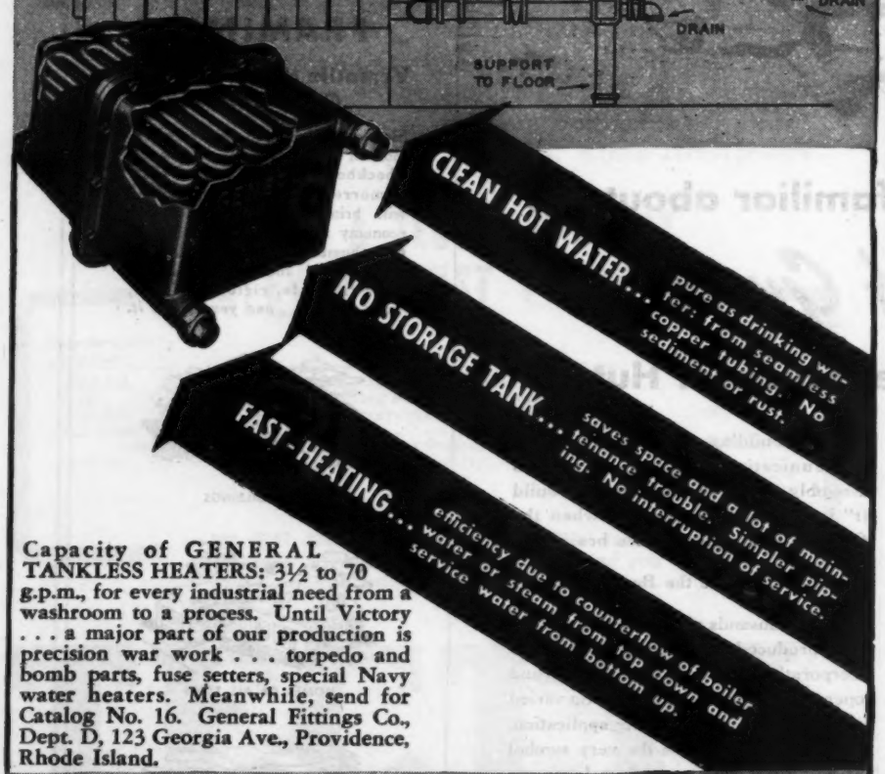
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the employee from the position of steward, it violated the employee's civil rights by expelling him. (Henry Morgan vs. United Electric Workers, Ill. Super. Ct.)

* *Reinstatement Ordered Despite Disability*

An NLRB order of reinstatement may not be circumvented because of the physical disability of the employee discriminatorily discharged. The employer is not left without any recourse, because he may still discharge the employee after reinstatement, if he is actually unfit to work. Failure to reinstate, however, would mean accumulation of back pay due the employee. (Salmen vs. Cowan, CCA-5)

* *Freedom of Speech Sustained*

An NLRB's cease and desist order against a local chamber of commerce which conducted a campaign against the choice of a union by employees of a local business and, in the board's opinion, paralleled the company's anti-union campaign, was denied enforcement by a circuit court of appeals. The court held that the organization in question did not have a coercive effect upon the employees, but was merely exercising its right to free speech. (NLRB vs. American Pearl Button Company, CCA-8)

* *Foremen's Conduct Held Unfair Labor Practice*

Foremen's misinterpretation of a no-solicitation rule resulted in an employer being found in violation of the Wagner Act, because of the promulgation of a plant rule prohibiting solicitation on company property. Although the employer contended that the rule was not intended to prohibit union solicitation for membership outside working hours, some of his foremen interpreted the rule as prohibiting solicitation at any time on company property, and threatened punishment for such solicitation. The board held that such misinterpretation on the part of some of the foremen resulted in discouraging lawful union activity. (Illinois Tool Works, NLRB)

* *Held Discrimination*

The NRLB's order of reinstatement of a discriminatorily discharged employee was held justified despite evidence that proved the employee's incompetence. The board found that the employer had engaged in anti-union activity in other respects, and that the employee, prior to his activity in the union, had been given a wage increase and promised a permanent job. (NLRB vs. Servel, Inc., CCA-7)

* *Held Interference*

The layoff of an employee who was editor of a union paper until he would retract an erroneous statement made in the paper, was deemed by NLRB an act of unlawful interference on the part of the employer. Although, the board explained, the employer had the right to request a correct statement of facts, he had no right to make his requests a demand, with the threat of individual punishment, for that which was a concerted act on the union's part. (Illinois Tool Works, NLRB)

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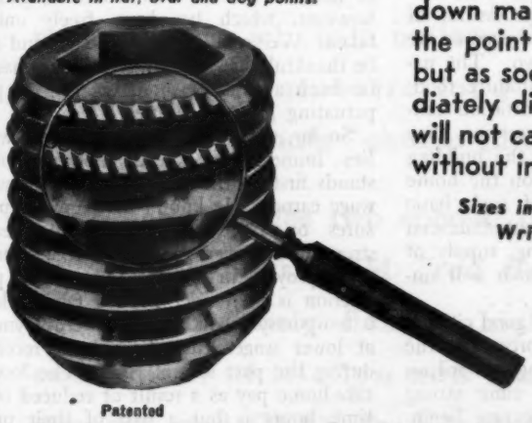

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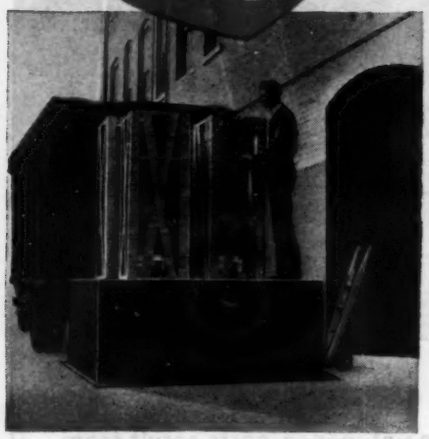

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Tasks That Lie Ahead

GEORGE W. TAYLOR, Chairman, National War Labor Board, at a Public Affairs meeting of the Chicago Association of Commerce

I have had the privilege of sitting down with business men and labor leaders to do some frank "thinking out loud" about the challenging tasks which lie ahead of us all. In soberly looking ahead, one quickly realizes that our duties as citizens continue to take precedence over our rights. There is still a terrible war to win. We are still in grim combat on the home front with the perils of inflation. The task of laying plans for a prosperous nation at peace is still to be accomplished.

These are primarily your tasks. We who have assignments in Washington know full well that the overwhelming production strength of America lies in the work and in the spirit and in the sacrifices of factory managements, farmers, industrial workers, white collar workers, and all the rest. We on the National War Labor Board fully realize that our difficult program can be accomplished fundamentally only through the voluntary acceptance by management and by labor of the regulations and procedures which are necessary for the essential objectives of avoiding interruptions to production in wartime and of preventing a disastrous inflation. These basic necessities of a wartime economy must be realized while at the same time we cope with the new job of converting to the production of civilian goods a substantial portion of the facilities which have been devoted to manufacture of machinery for war.

The combination is tougher to beat than any economic situation we have yet faced on the home front. It is not possible precisely to forecast all the conflicting economic pressures which will arise. One many reasonably anticipate, however, that the supplies of the basic necessities of life will become scarcer than ever as we move inexorably toward Tokyo. The nation's vast resources which produce food, clothing, shelter, and transportation cannot be mustered out of war service; they cannot as yet be devoted to the building up of a more abundant life on the home front. Nor will the lack of such basic necessities be adequately counterbalanced by the small, though growing, supply of durable consumers goods which will undoubtedly become available. . . .

It is also a responsibility of good citizenship to understand that forces on the supply side are mainly pushing upward on prices, while at the same time strong downward pressures on wages are beginning to develop. The latter tendency was not present on February 20, 1945, when the public members of the National War Labor Board recommended to the President against any change in the program under which basic wage scales had been, on the average, stabilized at about 20 percent above 1941 levels. The recommendation was made in full recognition of the fact that the cost of living had increased by about 30 percent. We believed that continuance of the wage stabilization program was equitable because the difference was more than made up by other indirect forms of wage increases arising from the manner in which basic wage rate schedules were administered in wartime.

It seemed to us entirely equitable to take as the basic stabilization rule the money actually earned for an hour's work at straight time. Under wartime operating conditions the hourly earning of the average worker has been increased by a great number of factors beside changes in wage rate schedules. Millions of wage earners have had their first opportunity to work in the relatively high wage heavy goods industries. Within plants a decided acceleration in promotion and merit increases has given many employees a first opportunity to work at more responsible jobs. Piecework systems have produced high earnings partly as a result of increased effort, but also because of more favorable operating conditions . . . change in the type of work.

Average Worker Earns More

These practices, and many more having a similar effect, have greatly increased the straight time hourly earnings of the average worker. . . . We figure that the amount paid the average employee for an hour's straight time has increased more than 36 percent even after discounting the heavier employment in war industries.

I believe that everyone of us will, upon sober reflection, conclude that the well-being of the great majority of wage earners has not been impaired up to now by the stabilization program. To earn the relatively high wages which have been paid, factory employees have worked harder than ever to produce a torrential output of goods. This is a wartime obligation, however, which has been freely undertaken. We've all done very well, and can be thankful that a runaway inflation has so far been avoided without creating or perpetuating grave inequities.

So far, so good. The question of what lies immediately ahead, however, now stands first in the mind of virtually every wage earner. He knows that upward pressures on prices continue with greater strength than ever. . . . And a large number of employees in factories whose war production is no longer needed face at least a temporary layoff and then employment at lower wages than have been received during the past several years. The loss of take-home pay as a result of reduced overtime hours is but a part of their problem . . . a considerable amount of downgrading and reclassification is to be expected as a normal aspect of the reconversion period . . . (and) this process and similar ones mean that the wages paid to the average employee for an hour's work will go down in many cases without

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Baldwin-Hill Co., 512 Klagg Ave., Trenton 2, N. J.

Send information on products checked below:

☐ Free sample of B-H No. 1 Cement
☐ No. 100 Pipe Covering—effective up to 1200° F. (for long runs overhead, underground, Diesel exhausts)
☐ Mono-Block—the one-block insulation for all temperatures up to 1700° F.
☐ Black Rockwool Blankets (felted between various types of metal fabrics)

NAME _____ POSITION _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

any change in wage rate schedules . . . Since these adjustments will be coupled in many instances with a loss of overtime hours, it is now necessary carefully to reappraise the wage stabilization program . . . It seems clear that the board must be ready to recognize the need for correcting any new inequitable wage relationships which may develop during the stresses and strains of reconversion . . .

Restraints on wage increases have been imposed by Congress because of the necessities of wartime stabilization in the interests of all our people. They should be ended as soon as resumption of the flow of consumer goods and services removes the danger of inflationary price increases and when the bidding of employers for employees' services will no longer be upsetting to the full utilization of war production facilities. It will be a very happy day when economic restrictions can be safely removed. For that will be the day when we start to move onward over roads of peace to a greater prosperity than has yet been experienced. That movement cannot be merely a Washington paper plan. It must be based upon a determination of Americans everywhere to work together for increased productivity, lower costs, lower prices, large volume distribution, and high wages.

•

Pay Check Service Provided for Workers

A service for workers that saves them time, eliminates the possibility of lost pay checks, affords an authentic income tax record, and generally promotes their peace of mind, has recently been inaugurated by R. G. LeTourneau, Inc., Peoria, Ill. Not unusual for executives, the service consists of sending workers' checks directly to the banks of their choosing, and having them deposited in checking accounts. Thus it is made easy for the worker to pay his bills without having to take time out to get money orders, to keep all his receipts in one place, and generally to control his spending—especially of the little change that disappears so readily, and so inexplicably.

Workmen's check stubs are mailed to them the same day their pay checks are credited to their bank checking accounts. Thus prompt information is furnished about current earnings, premiums, bonuses, and deductions.

The service was put into effect as the result of a suggestion offered by one of LeTourneau's workers.

•

Study Will Help Industry to Protect Workers' Eyes

Further evidence of the importance manufacturers are placing on protection of workers' eyes is shown by the research program recently initiated at Battelle Institute, Columbus, Ohio, under the sponsorship of the American Society of Safety

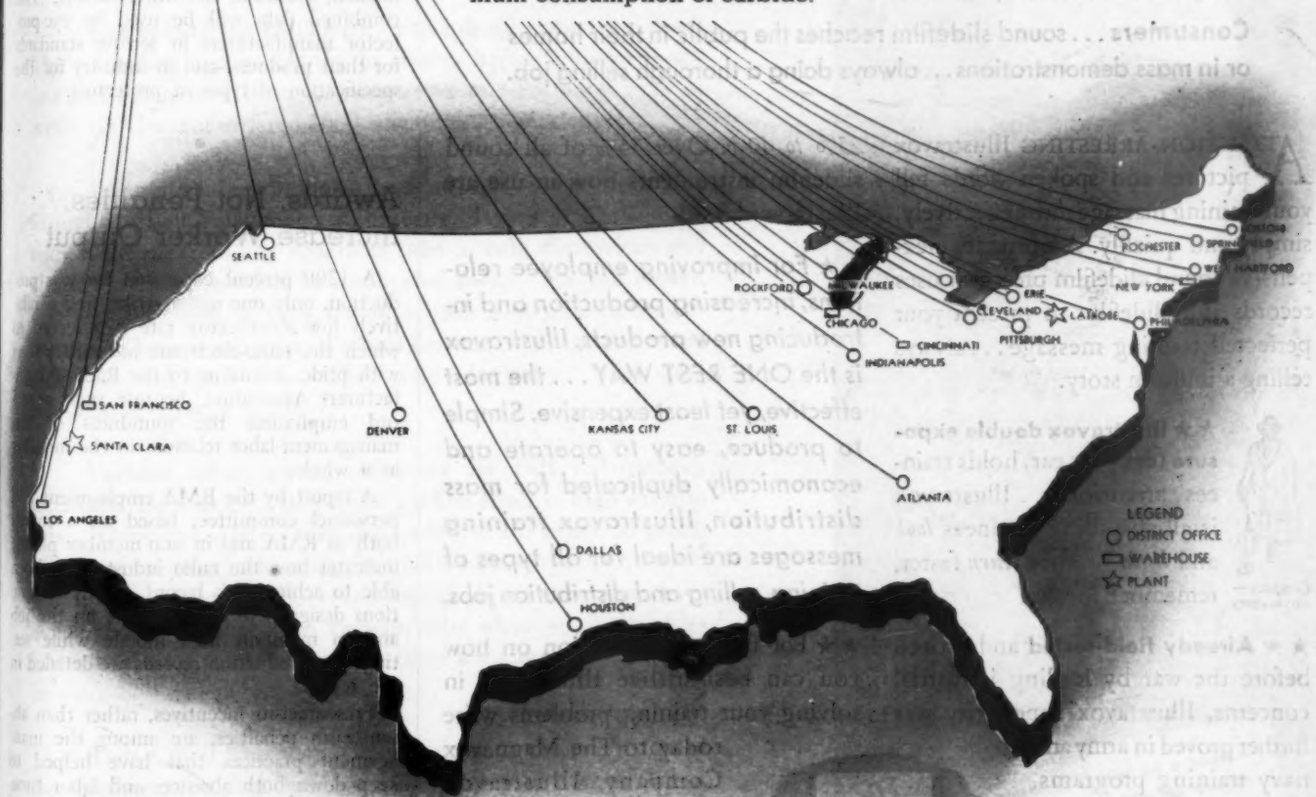
KENNAMETAL—THE ALL-AMERICAN CARBIDE

Serviced by a Nation-Wide Organization

The ingredient that distinguishes steel-cutting Kennametal from other cemented carbides (the unique intermetallic compound, $WTiC_2$) is an American invention, developed in 1937 by the president of Kennametal Inc. Using $WTiC_2$ as the key ingredient, he began making Kennametal tool blanks, of graded compositions suitable for different steel-cutting purposes, in a small plant employing twelve persons, at Latrobe, Pa.

Kennametal soon became established as the tool material that made possible machining of hard steel, accurately, at economy-promoting speeds. In eight years its use has spread, until today Kennametal Inc. has grown to such stature that it successfully serves hundreds of America's major metal-working plants.

Kennametal Field Engineers are more at home in these plants than in their own offices. Their on-the-spot "know-how" enables Kennametal users to obtain optimum production from a tool material that has demonstrated amazing inherent effectiveness. Call on them—they are at your service to help you get maximum output with minimum consumption of carbide.



HOW YOU'VE GAINED FROM KENNAMETAL'S GROWTH

Kennametal—constantly improved throughout the years—now costs its users less than one-tenth of what it did when introduced. This price reduction has been achieved wholly because of increased production and improved manufacturing technique—the very conditions that you can help to bring about in your metal-working plant, through proper utilization of Kennametal tools.

Why ILLUSTRAVOX Training Is The One Best Way

ILLUSTRAVOX VISUALIZES MESSAGES TO:

Employees . . . tells company policies as you want them explained . . . reaches workmen on the job.

Distributors . . . introduces new products dramatically, effectively . . . reaches all phases of distribution simultaneously.

Consumers . . . sound slidefilm reaches the public in their homes or in mass demonstrations . . . always doing a thorough selling job.

ATTENTION-ARRESTING Illustravox pictures and spoken words tell your training message most effectively, simply and quickly. A portable, inexpensive sound slidefilm projector uses records and slidefilm to present your perfected training message . . . always telling a uniform story.

Compact—easy to carry

★★ **Illustravox double exposure** (eye plus ear) holds trainees' attention . . . Illustravox is all-absorbing. Trainees *look* and *listen* . . . they *learn* faster, remember longer.

★★ **Already field-tested** and proved before the war by leading industrial concerns, Illustravox superiority was further proved in army and navy training programs. *Accelerated war-time schedules were cut as much as 25% to 40%.* Over 75% of all sound slidefilm instruments now in use are Illustravox!

★★ *For improving employee relations, increasing production and introducing new products, Illustravox is the ONE BEST WAY . . . the most effective, yet least expensive. Simple to produce, easy to operate and economically duplicated for mass distribution, Illustravox training messages are ideal for all types of training, selling and distribution jobs.*

★★ For further information on how you can best utilize Illustravox in solving your training problems write today to The Magnavox Company, Illustravox Division, Dept. FM-7, Fort Wayne 4, Indiana.

The Illustrated Voice

ILLUSTRAVOX

DIVISION OF THE **Magnavox** COMPANY · FT. WAYNE

MAKERS OF FINE RADIO-PHONOGRAPHS

Engineers, Engineering Section of the National Safety Council.

Planned to involve a year of investigation, the program is intended to provide information that will be used to help in combating the some 75,000 disabling eye injuries and several hundred thousand non-disabling injuries that occur annually in industry. It will apply particularly to the evaluation of the performance requirements and specifications of satisfactory plastic eye protectors.

Eye protectors, such as goggles and face shields, are the final means of eye protection for individual workmen. When correctly designed—and when worn—they protect from flying chips of metal, splattering chemicals, sparks, and other hazards. If not of sufficient protective power, however, they give false security, and if uncomfortable or tiring, workmen refuse to wear them.

The research program will include both laboratory and statistical investigations. A field survey of experience with the various types in use at present will be made. Proceeding concurrently will be physical and optical tests to determine adequacy of protection, design, light transmission, eyestrain, and other factors. The combined data will be used by eye-protector manufacturers in setting standards for their products, and in industry for the specification of types of protectors.

•

Awards, Not Penalties, Increase Worker Output

A 1200 percent expansion for war production, only one major strike, and a relatively low absenteeism rate is a record to which the radio-electronic industry points with pride, according to the Radio Manufacturers Association, because such a record emphasizes the soundness of the management-labor relations in the industry as a whole.

A report by the RMA employment and personnel committee, based on a survey both in RMA and in non-member plants, indicates how the radio industry has been able to achieve this record. Many innovations designed to keep workers on the job and to maintain high morale while setting new production records are detailed in the report.

Presenteeism incentives, rather than absenteeism penalties, are among the management practices that have helped to keep down both absences and labor turnover. Double holiday pay, extra and paid vacations, merit rating systems, war workers' honor rolls, Saturday half-holidays to transact personal business, no time clocks, music broadcasts, smoking permitted on duty, group insurance, free vitamins and cold vaccines, women counselors, free services on income taxes, housing, and rationing, employee rallies, absentee report cards, and exit and return interviews, are among the other practices that have helped this industry to maintain high production and good morale.

DUPLICATING A GERMAN VACUUM TUBE IN 3 DAYS

Just behind the battlefront, a telephone system lay dead. The retreating enemy, hoping to return, had not blown it up, but had taken with them its vacuum tubes. To put it back to work, the General ordered 1000 new tubes — spot delivery.

A sample tube was flown back to the United States and brought to Bell Telephone Laboratories. It was of German design, different from any American tube in both dimensions and characteristics. Could it be duplicated soon? The job looked feasible. Within three days, try-out models were on their way to Europe. Three weeks later, Western Electric Company had made and delivered every tube. They were plugged in; vital communications sprang to life.

Vacuum tubes are an old story for Bell Laboratories scientists. Back in 1912 they made the first effective high vacuum tube. Three years later, they demonstrated the practical possibilities of tubes by making the first radio talk across the Atlantic, pointing the way to radio broadcasting. Since then, they have developed and utilized the vacuum tube wherever it promises better telephone communication — there are more than a million in your Bell Telephone System.

Today, Bell Telephone Laboratories is solving many of the toughest tube problems faced by the Armed Forces. When the war is over, it goes back to its regular job—keeping American telephone service the best in the world.

• This electrical replica of a heater-type pentode was made for use in German telephone repeaters.

BELL TELEPHONE LABORATORIES

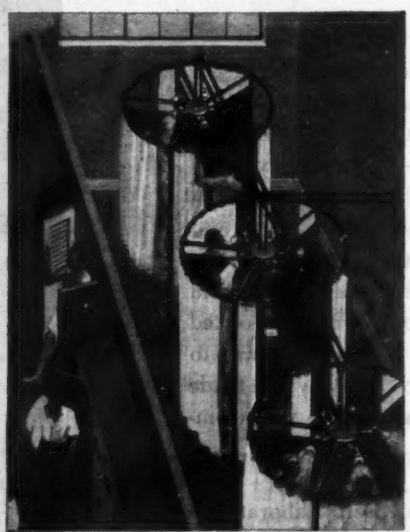
Exploring and inventing, devising and perfecting for our Armed Forces at war, and for continued improvements and economies in telephone service.

"I've stopped calling John a Work-Mole!"

What's a Work-Mole?

"Why that is the name I gave John when he used to come home from work still covered with grime and dirt from his job. But I can't call him that any more because NOW he comes home clean, refreshed and respectable looking, just like Mrs. Jones' husband."

Yes, more and more progressive managements are taking steps to make the *Work-Mole* an extinct species for they know that it is much easier to keep a worker satisfied and "on the ball" when he can clean himself up at the end of the shift, and leave the plant refreshed instead of tired and dirty.



A practical arrangement of the 5-stall showers at end of locker-room. Constant-temperature feature minimizes scalding hazard

But there are other sound reasons too, for installing Bradley Multi-Stall Showers. For they offer the same advantages of savings on maintenance, installation costs, and water consumption as do Bradley Washfountains. One 5-Stall shower unit needs only three piping connections, one for hot water, one for cold and one for the drain, as compared to the 15 piping connections required for 5 ordinary showers.

Bradley's Multi-Stall Showers are made in 3- and 5-stall models partially assembled for quick economical installation in either new or existing buildings. See pages 12 and 13 of latest Catalog 4308 for complete details and floor plans. If copy of Catalog and Washroom Survey Sheet are not at hand, write BRADLEY WASHFOUNTAIN CO., 2215 W. Michigan Street, Milwaukee 1, Wisconsin.

BRADLEY multi-stall showers

Latest illustrated Catalog 4308 and Washroom Survey Sheet sent upon request. Write today.

A Practical Labor Relations Program

E. F. RICHARDSON, Vice-President and Treasurer, Management Control, Inc., Dayton

The recent realization of the tremendous effect of successful labor relations upon productive output has resulted in the application of considerable thought and time to this problem. Speeches have been made and articles have been written concerning effective means for obtaining maximum results in the labor relations field. However, too much of this effort has been theoretical in its approach and non-productive in its result.

Practical solution to this problem is reached by acceptance of, and construction of the labor relations plan around, two basic fundamentals:

1. Every human being is interested in, and willingly spends continuous constructive effort upon, only those endeavors over which he has some control.

2. The average employee is primarily interested in three elements of his job—*wages, working conditions, and hours.*

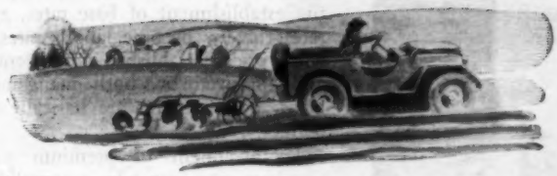
Regardless of other concepts introduced or already a part of the labor relations policy of any company—guaranteed employment, insurance programs, premium payments, or a variety of others—sound application of these two fudamentals is essential to successful labor relations and, therefore, to maximum operating results.

The principal interest of the average employee in any job is his "take-home" pay. This may consist of one or two parts—base wages and/or premium payments.

Job Evaluation a Necessity

Sound base wages can only be established by job evaluation. Organization for evaluation is a rating committee of four consisting of an experienced job evaluation engineer and the factory superintendent, the foreman and an elected representative of labor for each department to be rated. The last two change with each department. Mechanism for rating consists in the measurement of each job in terms of its common factors of knowledge required experience, dexterity, accuracy, physical effort, mental application, visual demand, responsibility for equipment, responsibility for safety of others, responsibility for product or process, undesirable conditions, and health and accident hazard. Numerical grades assigned to each degree of each factor result in a total numerical grade for each job rated. Highest numerical grade is made equivalent to the maximum base rate, as determined by management, and lowest numerical grade is made equivalent to the minimum base rate. Within these limits, other base rates are established in relation to the ratio of the respective numerical grades to the highest and lowest numerical grades.

Rates thus established must be correlated with the current cost of living index so that changes in cost of living can be immediately offset by changes in



WHEN your equipment calls for small horsepower, you're saving money when a Coppus "Blue Ribbon" Steam Turbine is on the job.

Coppus makes turbines in six frame sizes from 150 HP down to fractional — so you can "fit" the power more closely to the need. No reason to pay extra for ordinary "elephant power" turbines, when you have a small horsepower requirement.

Many well-known manufacturers of original equipment have selected Coppus turbines. And they are to be found on U. S. destroyer escorts, driving vertical lubricating oil pumps . . . on U. S. Casablanca class aircraft carriers, driving main and auxiliary circulating pumps and fire pumps . . . on more than 90% of all Landing Ship Docks, driving condensate and clean ballast pumps.

A job for a Jeep, not a Truck

You, too, can rely on their dependable performance to meet your requirements for "jeep" power. Like all Coppus "Blue Ribbon" products (blowers, ventilators, gas burners, etc.), the Coppus turbine is a precision-made product — its accuracy controlled by Johansson size blocks — and every turbine is dynamometer-tested before shipment. Since 1937, more than 85% of orders have been repeat orders. Write for Bulletin 135-10. COPPUS ENGINEERING CORPORATION, 107 Park Avenue, Worcester, Mass. Sales Offices in THOMAS' REGISTER. Other products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

PUTTING DOWN A FLOOR for 1970+

INSTALLING A BELDEN ACID-PROOF BRICK FLOOR IN THE PLATING ROOM OF THE HOOVER COMPANY, NORTH CANTON, OHIO.

Barring earthquakes or unforeseen acts of God, engineers of the Belden Brick Company believe this new floor will be in use after 1970.

The installation follows carefully proved methods developed for maximum resistance to chemicals, acids and abrasive wear. Here, workmen are "hot-pouring" a special acid-proof cement. Even the trenches are of acid-proof brick, rounded off at the corners by using a stock shape . . . the "bull-nose stretcher."

Ideal for use in an acid and plating room, this floor will endure daily exposure to acids, alkalis, grease, sand, steam and water!

Write **today for a new 16 page brochure telling how to install Belden Acid-Proof Brick floors in new buildings, or over old floors in old buildings. Illustrations show Belden Floors in all branches of industry. A wide range of standard shapes in varied sizes and thicknesses is available.**

NEW YORK OFFICE. 15 EAST 26TH STREET • DETROIT OFFICE. 14305 LIVERNOIS AVENUE

THE Belden Brick COMPANY

Manufacturers of Structural Clay Products Since 1885

CANTON 1, OHIO

base rates. To maintain base rate flexibility, and yet prevent excessive changes in base rate structure, it is advisable to establish a policy specifying review and revision of all base rates semiannually or whenever there is a 5 percent variation in the cost of living index.

Base rates obtained in this manner are completely acceptable to labor. First, such rates are fair. To prove such fairness, the method and numerical grades obtained must be open to inspection at all times. Second, because a labor representative is a member of the rating committee, labor exercises some element of control over the establishment of base rates, and such rates thereby become labor's rates. Thus, labor prices established are acceptable to, and approved by, both mangement and labor, because rates are basically fair and correct.

Establishment of premium payments, like base rates, must be accomplished in a spirit of friendly cooperation. To facilitate payroll computation, and to harmonize with base rates which vary with changes in the cost of living index, the productive hour is considered the most acceptable basis for an incentive plan in most cases. If the plan is to be completely equitable 100 percent of the direct labor savings should be returned to the employee, since the company benefits through savings in overhead. However, if significant elements of the job change, the standard is changed. An incentive plan based on these fundamentals is obviously fair, and, if properly established and installed, will be completely acceptable to both management and labor.

Labor-Management Cooperation

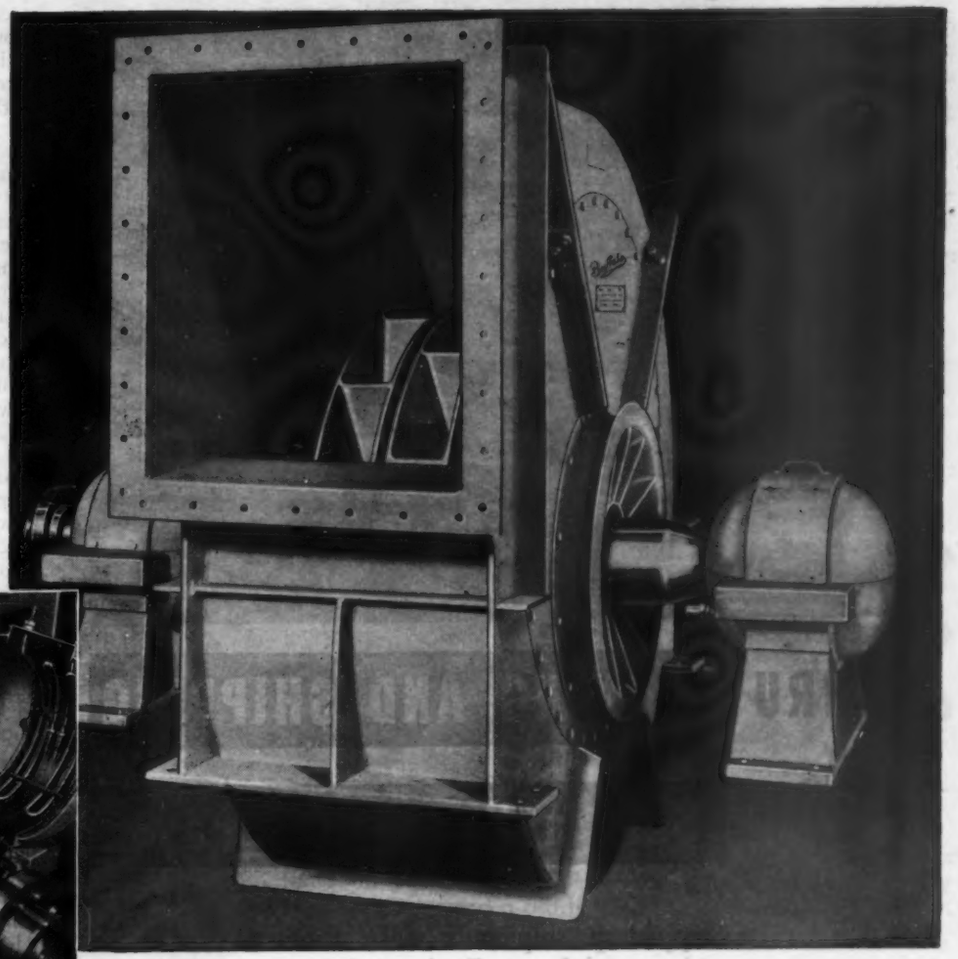
Installation of successful incentives must start with discussion between management and labor relative to the reason for application and installation of incentives to the operations involved, and the general benefits to be derived by management and by labor. Depending on the size of the plant, from three to five elected labor representatives are then chosen to work on the wage incentive installation with the time study engineers. To work out the time bonus plan in conjunction with these labor representatives, it is essential that they become thoroughly competent in making actual time studies. This requires considerable training. Upon completion of this training, the labor representatives assist the time study engineers in observation, analysis, and computation of all rates so that such rates have labor's approval, prior to application. Finally, a time bonus manual explaining all details of the plan is prepared, issued, approved, and signed by management and the labor representatives. The plan thereby becomes a joint effort, which is workable because both management and labor exercised control over it and are a part of it. A standards review committee, with representatives of both labor and management, maintains the plan and decides upon disputed rate changes.

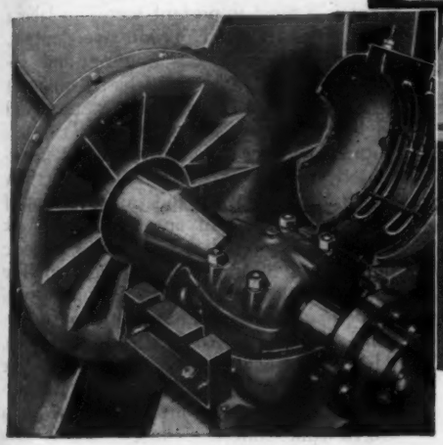
Base rates and premium payments thus established create an average employee who is thoroughly satisfied with his wages because he was a part of their establish-

Handling Air At 100° Below Zero

Sturdy construction is combined with high efficiency in this special Buffalo low temperature fan.

Small illustration shows Calrod-lined bearing cover lifted. Lower part of bearing cover is also lined with Calrod.





When you're flying at 40,000 feet, it's important that instruments function properly, that motors operate smoothly — that valves and meters respond as they should. In order to check all this equipment before it's in the air, testing laboratories reproduce stratosphere conditions on the ground.

"Buffalo" fans have been chosen for circulation of air in many of these laboratories.

The special Buffalo fan illustrated above is for one of the latest and most complete testing plants. Designed to handle 62,400 cfm at 4½ lbs. (equivalent to 120 inches of water pressure) this fan must also handle a temperature range from 100° above zero to 100° below. While the 200° differential is nothing exceptional, many commercial jobs having a much wider range, the low temperature involved produced interesting lubrication problems. To give proper bearing performance SKF oil-lubricated bearings were used. To keep bearing-oil fluid, Calrod heating coils have been placed in a special bearing cover, which is arranged for easy inspection.

When your fan problems call for an unusual degree of engineering ability, let Buffalo engineers make recommendations.

"Buffalo" "First For Fans"

Buffalo Forge Company

471 BROADWAY BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

fans for industry

Conveying

THRU PACKING AND SHIPPING

Sets a Pace that Pays!

Stepped-up shipments make room for more orders, and Logan Engineered Systems like the one shown above keep packing and shipping room operations abreast of manufacturing. Notice variety of equipment used here. Roller Spiral at right lowers material to this storage area from conveyorized assembly and packing on floor above. Belt and Roller Conveyors in center and foreground facilitate storage and dispatching to shipping platform. Write for the valuable Logan catalog.

LOGAN CO., INC., 510 Cabel St., Louisville 6, Ky.

Logan Conveyors

PUT *FLOW* INTO PRODUCTION

ment. He knows the rates are fair, and he is aware of better jobs, provided he can qualify for them. Wage disputes are reduced to a minimum under such conditions.

In addition to wages, the average employee is interested in the working conditions incident to the plant in which he is employed. Degree to which working conditions can be improved is determined by economic considerations within the specific company. But, however they are improved, the work should be done cooperatively by management and labor. Satisfactory working conditions are obtained by three principal means:

1. A working conditions committee, composed of two industrial engineers and two elected representatives of labor, analyzes every job class every six months to determine the current degree of light, heat, fumes, dust, smoke, noise, air, odor, unguarded equipment, and so forth, and sets up a program, including the agency responsible for taking action, for reducing the disturbing element or elements to a minimum. Progress on this program is reviewed monthly by the committee.

2. Methods employed by the personnel department are organized and techniques developed to determine not only the prospective employee's physical and mental experience and skill but also his social and emotional composition. Effective placement is a most important factor in labor's job happiness and productive output. Continuous on-the-job training and opportunity for advancement based on merit rating must be provided. A personnel advisory committee, composed of the personnel manager and two elected representatives of labor, can function effectively in the determination and improvement of the social aspects of an employee's work as well as in over-all inspection of periodic merit rating of employees by foremen. The personnel department also provides sympathetic and intelligent solutions to personal and emotional aspects of the job, which occur because of the inherent nature of the human being. Here, also, the personnel advisory committee can perform a worth-while function, since labor is in a much better position to determine the disrupting influences upon each employee's life, so that causes may be discovered and eliminated.

3. Management provides essential facilities to take care of employees while they are at the plant but are not engaged in productive work. These essential facilities include clean and modern restrooms, efficiently operated plant hospital, light and clean cafeteria, and facilities for entertainment and relaxation during the lunch period. This may be athletic competition, moving pictures, social activities, or any of numerous other activities. These are the minimum essential services that must be provided to achieve satisfactory working conditions. Other services can be provided at the discretion of the employer, but they are not essential and need not be included in an employee service program. Employee management of these service activities, in conjunction with the personnel department, makes the program

What's going to happen to the SUZY Q?

Remember the graveyard of rusting ships after the last war? For years a grim reminder of surplus war production, they also represented a practically bankrupt shipbuilding industry.

Today, America's aircraft industry accounts for a substantial proportion of our total national economy. That industry has produced more than a quarter of a million planes since Pearl Harbor! Its plants, equipment and production represent 50 billion dollars worth of taxpayers' money.

Here is the most valuable single peacetime legacy of war. . . . Here is power to maintain peace, insure our national security and provide jobs for millions of Americans . . . And here is a critical problem.

For the percentage of profit earned by our aircraft industry is so low that its entire capital reserves amount to only a few days' operating costs! The lack of a sound national airpower policy could actually result in the collapse of a great industry and the promise it holds for the whole world.

We at Bryant know that we can sell many machine tools to a healthy peacetime aircraft industry. But far more important — those tools mean jobs, and our last chance to enforce peace throughout the world.

BRYANT GRINDER COMPANY SPRINGFIELD VERMONT, U.S.A.

• To meet new industrial requirements in many fields, REX-FLEX Stainless Steel Flexible Metal Tubing is now being produced in a new 6" I.D. size! This latest addition to the C.M.H. line of flexible metal hose makes possible the use of REX-FLEX in numerous new applications. Sizes now range from 5/16" to 6" I.D. (Incl.). Five standard wall formations are available.

In addition, this new 6" flexible metal tubing has all these outstanding REX-FLEX features: *18-8 Austenitic Stainless Steel . . . Non-Corrosive . . . Withstands Extremes of Temperature . . . Light Weight in Comparison to Strength . . . Great Burst and Crush Strength . . . High Fatigue Resistance . . . High Vibration Qualities . . . Pressure Tight for Liquids and Gases . . . Manually Bendable in Multiple Planes . . . Fittings Seam Welded to Form Uni-Metal Assemblies.*

Learn how REX-FLEX Stainless Steel Flexible Metal Tubing can meet your requirements. Write today for complete information!

Flexible Metal Hose for Every Industrial Use

ARMY E NAVY

CMH

CHICAGO METAL HOSE CORPORATION

MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

interesting and acceptable because it is one of joint endeavor.

A program of this kind for handling the problem of working conditions creates a mutually acceptable solution both for the employer and for labor, because it represents a common and united undertaking. If labor has had some measure of control in the establishment of the program, and if labor knows that the program established is completely fair, and that all phases of the program are available for inspection, no trouble will arise because of working conditions. It is only when labor does not know the facts, or is misinformed, that strife occurs.

The Matter of Hours

Finally, the average employee is interested in the hours of work in any job. Because legislative limits to maximum hours have been established (and it is apparent they will continue), principal phases of this problem have been taken from business by government. Management effort should be directed to constantly decreasing hours with a view to staying below the legislative limits. This trend, obviously, can continue only so long as labor or machine utilization can be improved. This necessitates an active and aggressive industrial engineering department and intelligent, constructively applied mechanical engineering. The important consideration in the question of hours is the trend of sales and productive output in terms of number of hours of work. So long as unit costs can be maintained or reduced, and so long as the backlog of sales orders does not increase substantially, reduction of hours of work is not a serious problem. However, if any of these factors are affected, management should show the facts to labor so that the question of hours does not become a matter for dispute, but rather a problem to be solved by a unified and combined effort.

As in the case of wages and working conditions, a policy of complete honesty, together with wholehearted desire by management to work with labor, creates mutual confidence and respect and practically eliminates any cause for dispute. Because the average employee shares in the control over the establishment of his wages, working conditions, and hours, the limits to each of these elements set by adopted company policy become his limits and are strongly supported by him.

Achievement of fair base wages, equitable premium payments, satisfactory working conditions, and minimum hours under a program of joint endeavor through committee action requires time and specialized skills, supplied either from within the company or with outside assistance.

What are these results? First, reduction to a minimum, if not complete elimination, of employer-employee strife. Second, employees who are happy about their jobs thereby producing maximum operating results (which means minimum costs to the employer). In view of these potentials, can any employer fail to include the application of the two basic fundamentals to the development of his labor relations program?

Simplified paper work for Contract Termination

Get full details in our booklet, "The ABC of Contract Termination"

A sound and simple system has been worked out that enables you to handle all three phases of contract windups smoothly and easily. Representative plants of all sizes and categories are finding it is thoroughly practical in actual use.

It is a system based on simplification of necessary paper work through use of the Mimeograph* duplicator. It assures smooth coordination, accurate control. It eliminates rewriting of constant data. It fills the very important government specification for fade-proof, permanently legible copy.

The whole procedure is explained in detail in our booklet, "The ABC of Contract Termination." It gives you suggestions for planning your termination organization, tells exactly what paper work is required, and shows a sample set of forms and a chart which tells how the forms travel, what they accomplish and how they meet all the requirements of the government.

Like thousands of others, we think you too will find this booklet a very real help. Get your copy by mailing the coupon below.

Mimeograph die-impressed stencils of the required OCS forms are available at once from your authorized Mimeograph distributor. They eliminate the need for preprinted forms. Type inventory information in position and reproduce form and fill-in together, as many copies as you need.

Mimeograph duplicator

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A. B. Dick Company, Dept. L-745, 720 W. Jackson Blvd., Chicago 6. Send me a free copy of your booklet, "THE ABC OF CONTRACT TERMINATION."

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"LESS SPOILAGE AND FEWER ACCIDENTS" WHEN DROP HAMMERS ARE MOUNTED on KORFUND

VIBRATION CONTROL

The operator feels no vibration when this drop hammer is in operation because he stands on an isolated platform.

A prominent aircraft company writes:

"Our Cecostamps are all mounted on floating concrete foundations, supported on Korfund Steel Spring Vibro-Isolators. By using these Vibro-Isolators we have been able to locate the hammers in the plant without causing any disturbance from vibration to adjacent equipment and to effect most efficient production. It is evident that the spring mountings will lessen the maintenance cost and increase the life of the machines. The efficiency of the workmen has also increased, resulting in less spoilage and fewer accidents."

What are these steel spring vibro-isolators? How do they work? How are they installed? Do many concerns use them? What do hammer manufacturers think about them? Can punch presses and other impact machines be similarly mounted?

These and many other questions are answered in a new catalog. Why not write for a copy and find out how you, too, can benefit through Korfund Vibration Control. Just ask for catalog A-600. No obligation.

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BOOKS

MUSIC AND SOUND SYSTEMS IN INDUSTRY

Barbara Elna Benson, in charge of record division, Station WMCA, New York, formerly program director, RCA Victor, New Jersey. McGraw-Hill Book Co., 330 West 42nd St., New York. 124 pages. Photographs, bibliography, "discology," index. $1.50.

One of the "Industrial Organization and Management Series." Shows manufacturers value of industrial broadcasting when properly used. Actual technique of organizing and operating a system is outlined. The importance of proper programming and broadcasting is discussed. "Discology" lists the music on records from three major recording companies, and classifies them according to their suitability for certain specific uses—work, opening, special, lunch. In five chapters: "The Organization of an Industrial Broadcasting System"; "Programming Music for Industry"; Broadcasting for Industry"; "Scientific Research on Music in Industry"; "The Evolution of Industrial Broadcasting, and Conclusions."

POSTWAR FISCAL REQUIREMENTS

Lewis H. Kimmel and associates. The Brookings Institution, Washington 6, D. C. 166 pages. Charts, index. $2.

Sixth in an integrated series of studies pertaining to post-war readjustment and reconstruction. In the present study, authors estimate the probable level of governmental expenditures (federal, state, and local) for the first reasonably settled post-war year. In 12 chapters: "Summary of Requirements: Fiscal Year 1948-9"; "National Defense"; "Veterans' Benefits"; "Regulations and Protection"; "Promotion of Economic Development"; "Promotion of Social Welfare"; "Debt Service"; "General Government"; "Miscellaneous Expenditures"; "Governmental Business Enterprises"; "Social Security Finances"; "Post-War Expenditures and National Income."

THE BOGEY OF ECONOMIC MATURITY

George Terborgh, Machinery & Allied Products Institute, 221 North LaSalle St., Chicago. 263 pages. Charts, index. $3.

An analysis of the theory of economic maturity, which rejects the theory and the pessimistic forecasts to which it has given rise. Advocates of economic maturity contend that the economy is being poisoned by chronic oversaving, reflecting inadequate opportunity for private investment. The shortage of investment outlets is said to be brought on by four developments: The decline of population growth, the passing of the frontier, the dearth of great new industries, and the increasing importance of depreciation reserves. These developments are analyzed and dismissed as substantially harmless.

TOP-MANAGEMENT PLANNING

Edward H. Hempel, Ph.D., Assistant Professor of Industrial Engineering, Columbia University. Harper & Brothers, 49 East 33rd St., New York. 414 pages. Forms, tables, woodcuts, index. $4.50.

Subtitled "Methods Needed for Post-War Orientation of Industrial Companies." Planned to set forth topics of major executive importance which require the planning and policy-making of the top-management group. Considers from a practical standpoint such topics as planning for size of the enterprise, product planning, planning for plant location, arrangement and machine layouts, as well as the integration of all these elements into a coordinated top-management policy. In three parts

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Fig. 1793—125-pound Iron Body Bronze Mounted Gate Valve with flanged ends, outside screw rising stem, bolted flanged yoke, bronze seats, and taper wedge solid disc. Available with taper wedge double disc—Fig. 1444.

478

Fig. 478—Iron Body Bronze Mounted "Pilot" Gate Valve with screwed ends, outside screw rising stem, bolted yoke and taper wedge solid disc. Sizes ⅛" to 2", inclusive, for 150 pounds W.S.P.; 2½" and 3", for 125 pounds W.S.P.

500

Fig. 500—125-pound Bronze Gate Valve, with screwed ends, inside screw rising stem, screwed bonnet and either taper wedge solid or double disc.

1503

Fig. 1503—Class 150-pound Cast Steel Gate Valve with flanged ends, outside screw rising stem, bolted flanged yoke and taper wedge solid disc.

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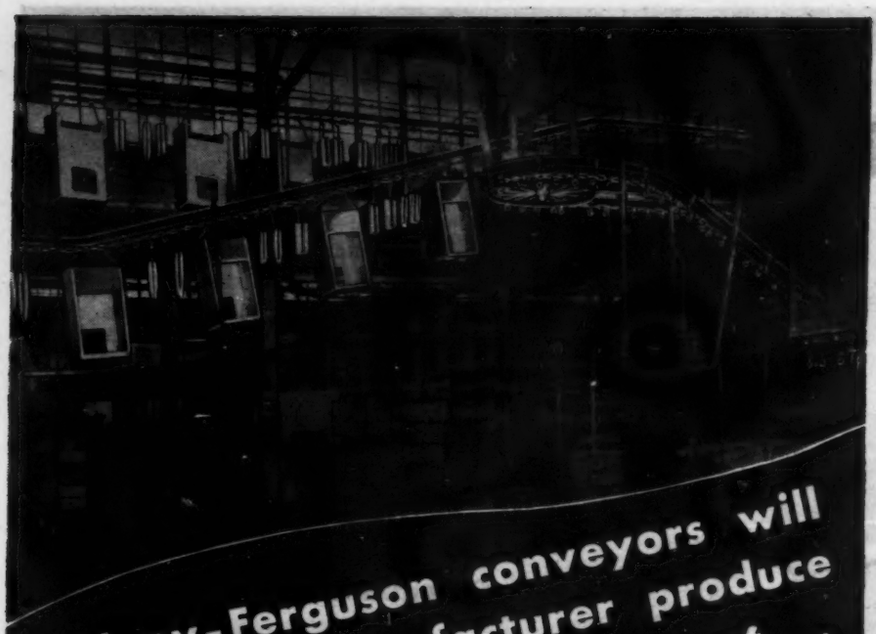

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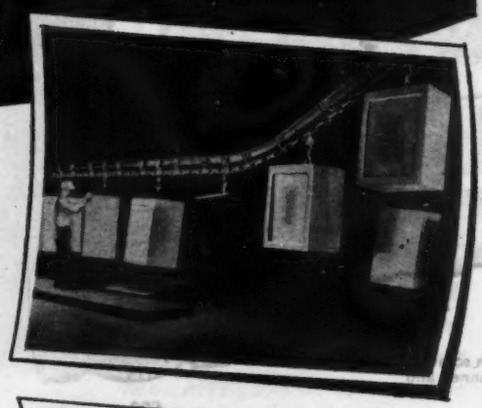

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CONTROLLERS FOR ELECTRIC MOTORS

Henry Duvall James, B.S., M.E., Consulting Engineer, and Louis Edwin Markle, B.S., Design Engineer. 324 pages. Photographs, drawings, charts, fingers, index. $3.50.

Subtitled "A Treatise on the Modern Industrial Controller With Typical Applications to the Industries." A manual on all types of commercial motor controls, describing their construction, performance, and operation. Gives pointers on maintenance. Also included are explanations and diagrams on electronic tube control, arc rupturing, time delay method of accelerating motors, protection of synchronous motors, obtaining regeneration with d.c. motors, overload protection, and so on.

ELEMENTARY STATISTICS

Hyman Levy, Professor of Mathematics, and E. E. Priedel, Assistant Lecturer in Mathematics, Imperial College of Science, London. The Ronald Press Co., 15 East 26th St., New York. 184 pages. Figures, Index. $2.25.

Covers part of the work on statistics and probability which has been taught at the Imperial College of Science to students of mathematics and physics during the past 20 years. Chapter headings include "Types of Measurement"; "Frequency"; "'Best' Value for a Set of Measurements"; "How to Measure Dispersion"; "Special Types of Frequency"; "The Accuracy of the Mean"; "Related Measurements"; "Correlation: The Measure of Trends"; "Elementary Ideas in Probability"; "The Meaning of the Correlation Coefficient"; "Some Mathematical Points"; "Gauss's Law of Error"; "Elements of Quality Control"; "The Limitations of Normal Statistical Analysis."

BOOKLETS

ESTABLISHING and Operating a Metal Working Shop. Industry Series No. 16. William H. Myer and associates, under the direction of H. B. McCoy. The Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce. 202 pages. Photographs, check list. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

THERE CAN BE JOBS FOR ALL. Beveridge's Plan for Full Employment. Maxwell S. Stewart. Public Affairs Pamphlet No. 105. Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York 20. 31 pages. Drawings. 10c.

CARTELS OR FREE ENTERPRISE? Thurman W. Arnold. Public Affairs Pamphlet No. 103. Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York 20. 31 pages. Cartoon drawings, comments, bibliography. 10c.

STAFF MANAGEMENT. F. W. Lawe, Personnel Manager, Harrods, Ltd. Institute of Labour Management, Aldwych House, London, W.C. 2, England. 28 pages. Appendix—Summary of Functions of a Staff Management Department. 1 shilling.

CONTROL OF SALARY EXPENSE. Edward N. Hay, The Pennsylvania Co. Financial Management Series No. 79. American Man-

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agement Association, 330 West 42nd St., New York 18. 14 pages. 35c.

EXECUTIVE COMPENSATION AND ACCOMPLISHMENT. Dr. Harry Arthur Hopf, Hopf Institute of Management. Financial Management Series No. 78. The American Management Association, 330 West 42nd St., New York 18. 22 pages. 75c.

INDUSTRIAL PROPERTY RECORDS FOR ACCOUNTING AND VALUATION USES. C. V. Armstrong, Research Associate. Iowa Engineering Experiment Station, Bulletin 160. The Iowa State College Bulletin, Ames, Iowa. 96 pages. Forms, figures. No charge.

EMPLOYMENT TESTS IN INDUSTRY AND BUSINESS. A selected, annotated bibliography. Industrial Relations Section, Department of Economics and Social Institutions, Princeton University, Princeton, N. J. 46 pages. 50c.

DATA FOR STATE-WIDE PLANNING OF VETERANS' EDUCATION. Ernest V. Hollis, Principal Specialist in Higher Education. Bulletin 1945, No. 4 Federal Security Agency, U. S. Office of Education. Superintendent of Documents, U. S. Government Printing Office. 69 pages. Tables. 15c.

INDUSTRIAL REHABILITATION. Safety Training Digest. The American Museum of Safety and the New York University Center for Safety Education, 8 Fifth Ave., New York. 92 pages. Forms. 35c.

HOW TO PREPARE FORMS for Wage and Salary Adjustments. A guide for securing approval of War Labor Board and Salary Stabilization Unit. The Bureau of National Affairs, Inc., 24th and N Sts., Washington 7, D. C. 106 pages. Forms, tables, index. $2.

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ON THE CALENDAR

SEPTEMBER

21, Association of Consulting Management Engineers, Inc., Program Meeting, University Club, Chicago. Nathaniel W. Barnes, Executive Secretary, 347 Madison Ave., New York.

Meetings Canceled

JULY

Silver Bay Conference on Industrial Relations, 28th Annual Conference, scheduled for July 25-28, Silver Bay-on-Lake George, N. Y. Earl M. Dinger, Secretary, 347 Madison Ave., New York.

AUGUST

American Institute of Electrical Engineers, National Technical Meeting. H. H. Henline, Secretary, 33 West 39th St., New York.

SEPTEMBER

Association of Iron & Steel Engineers, Annual Technical Conference, Pittsburgh. Brent Wiley, Managing Director, Empire Building, Pittsburgh.